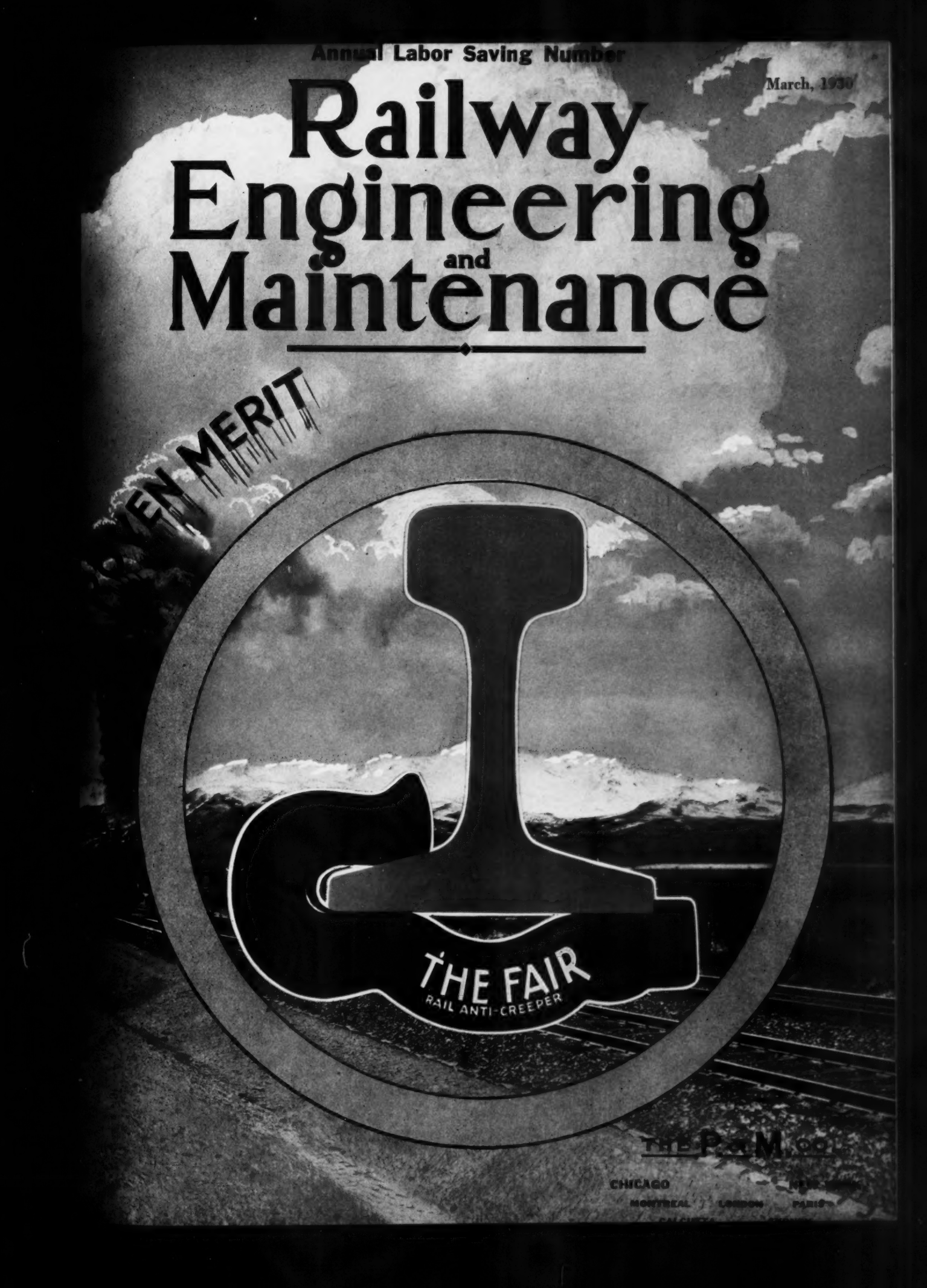
Annual Labor Saving Number

March, 1930

Railway Engineering and Maintenance



Frequent part turns of a nut

or reactive energy of HY-CROME?

WHICH does the alert railroad executive prefer to show on his cost sheets?

HY-CROME applied on every track bolt at every rail joint is conspicuously lower in cost than frequent re-wrenching by track gangs. Of the two cost elements—time and material—labor-time is usually the more expensive in any business. It is in railway track maintenance.

Main lines carrying heaviest, fastest traffic are where the largest savings can be demonstrated by HY-CROME. Bolting up the angle bars with HY-CROME when new track is laid insures permanent rail joint rigidity because the great reactive pressure and wide reactive range of HY-CROME automatically compensates for wear in thousandths of an inch where the track man compensates in part turns of a nut. Let a HY-CROME TRACK TEST prove it.

THE RELIANCE MANUFACTURING CO.
MASSILLON, OHIO
Engineering Materials, Ltd., McGill Bldg.
Montreal, Quebec, Canada

HY-CROME

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January, 15, 1916, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879.
Alphabetical Index to Advertisers, Page 92 Classified Index to Advertisers, 88-90

SAFEGUARD
Your Tie Investment
With the Lundie Tie Plate

THE Lundie Plate fulfills long life expectations from treated ties because it is the one tie plate that does not have a single sharp projection which cuts the protective layer of the treated timber.

Millions of Lundie Tie Plates in service under all conditions of traffic, demonstrate that they hold track to gauge without sacrificing any tie life by the use of destructive ribs.

This complete elimination of sharp projections makes Lundie protected ties last longest —assures maximum return from tie investments and makes certain worthwhile maintenance economies through minimizing tie renewals.

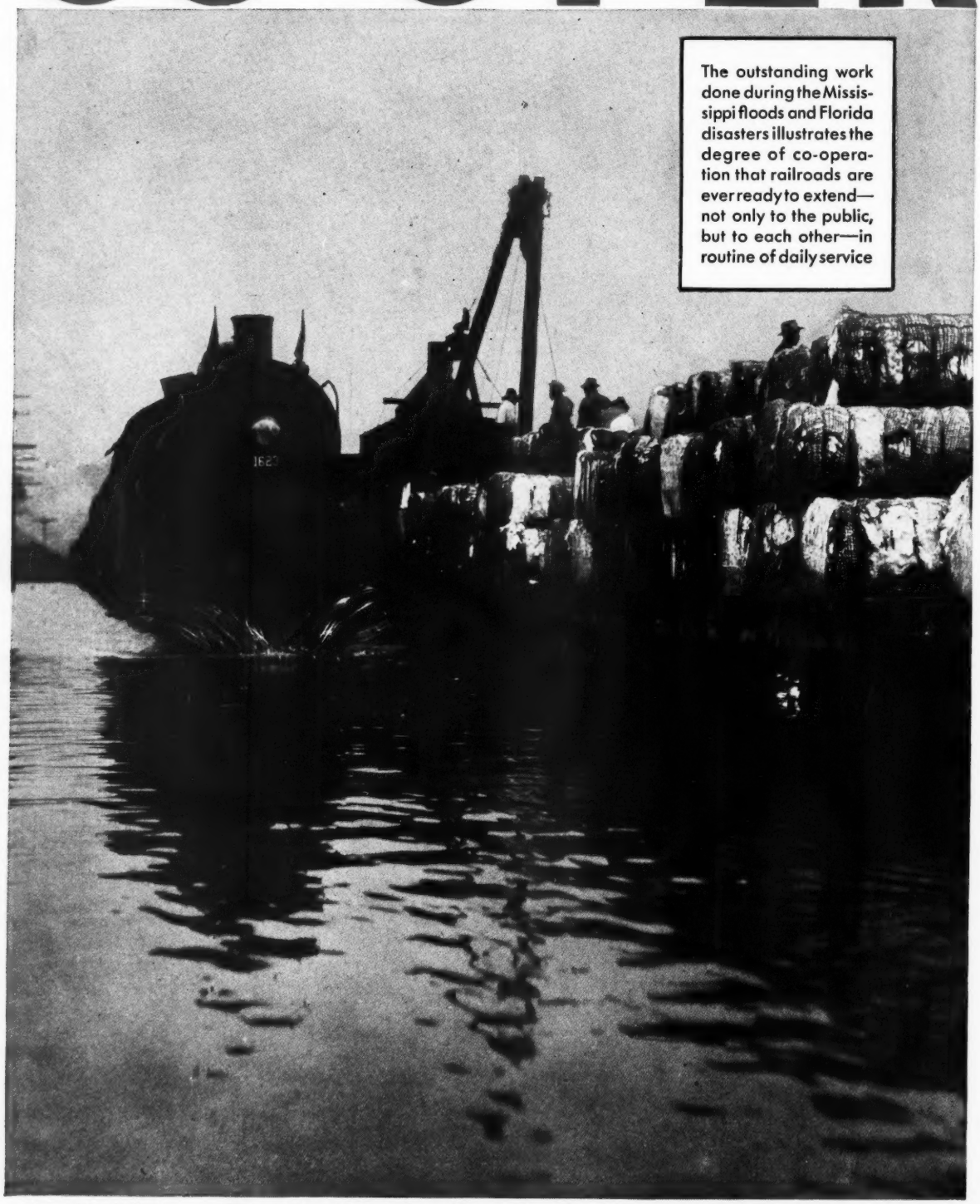
Investigation of the Lundie Plate will convince you why the bottom saves the tie.

At Space 89
National Railway Appliances
Association Exhibit

The Lundie Engineering Corporation
285 Madison Ave., New York
166 West Jackson Boulevard, Chicago

LUNDIE TIE PLATE

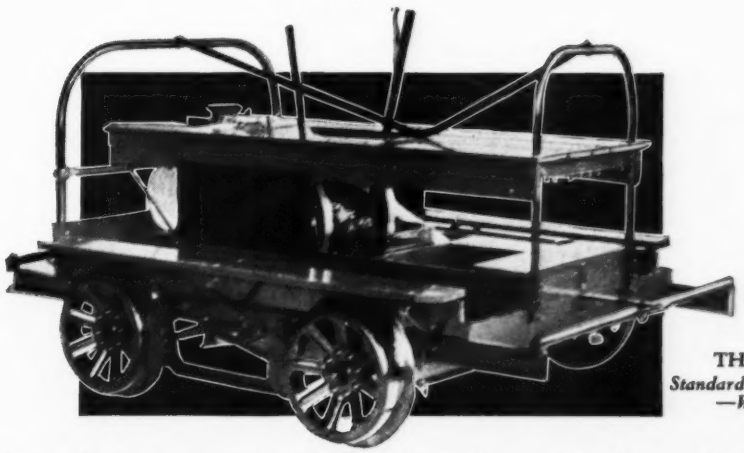
CO-OPER



The outstanding work done during the Mississippi floods and Florida disasters illustrates the degree of co-operation that railroads are ever ready to extend—not only to the public, but to each other—in routine of daily service

· THE · RAILROAD · WORLD ·

ATION



THE FAIRMONT S2
Standard Section Car—Two Types
—Wood or Steel Frame

The spirit of unselfish service motivating the Railroad World was the inspiration that brought world-wide leadership to the Fairmont organization.

This is seen in the Fairmont objective—to sell not equipment, but *lowest overall cost* of service. The fact that over half the motor cars now in use are Fairmont products is undeniable evidence that this objective has been consistently attained and the Railroad World appreciates the spirit behind it.

When you transact business with Fairmont, you deal with specialists who are ready with a *lowest cost* solution to every problem of motor cars on maintenance work. Representatives everywhere to serve you.

FAIRMONT RAILWAY MOTORS, INC.

FAIRMONT, MINNESOTA, U. S. A.

General Sales Offices: 1356 Railway Exchange Bldg., CHICAGO

District Sales Offices: New York City Washington, D. C. St. Louis San Francisco New Orleans

FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada *Foreign Representative:* BALDWIN LOCOMOTIVE WORKS

Manufacturers of section motor cars, inspection motor cars, gang and power cars, weed burners, ballast discers, ball and roller bearing engines, push cars and trailers, roller axle bearings, wheels, axles and safety appliances

Fairmont Mudge

Performance on the Job Counts

·KNOWS·FAIRMONT·

Armor-Like . . .

RED LEAD fortifies against CORROSION

Prolongs the life of iron and steel

AIR and moisture . . . these are the foes of structural metal. In contact with iron or steel, they shorten its life. Kept away, the metal will last indefinitely.

Protection That Lasts

There's only one way to get the kind of protection that lasts for years. That way, authorities agree, is by using pure red lead.

Here's why. Red lead paint *seals up* metal with a tough, dense, protective coat. Air or moisture cannot reach it. Thus corrosion is practically eliminated. And longer life for the metal is assured.

High Quality Red Lead

For over a hundred years, pure red lead has been the standard paint for iron and steel. Pure, fine and highly oxidized, Dutch Boy Red Lead offers a measure of protection that no other pigment can give. Comes in two forms—paste and liquid. The liquid (ready for the brush) is supplied in six colors . . . the natural orange-red, two shades each of green and brown . . . and black. The paste comes in orange-red, and can be shaded to dark colors.

For information on any special painting problem, write our Department of Technical Paint Service, in care of our nearest branch.

DUTCH BOY
RED LEAD

NATIONAL LEAD COMPANY

New York, 111 Broadway; Buffalo, 116 Oak St.; Chicago, 900 West 18th St.; Cincinnati, 659 Freeman Ave.; Cleveland, 820 West Superior Ave.; St. Louis, 722 Chestnut St.; San Francisco, 235 Montgomery St.; Boston, National-Boston Lead Co., 800 Albany St.; Pittsburgh, National Lead & Oil Co. of Pa., 316 Fourth Ave.; Philadelphia, John T. Lewis & Bros. Co., Widener Building.

See
this machine
at the
Railway Show
Coliseum
March 11
Booth

TRUE TEMPER
Safety Rail Fork

Above Operator is Shown Turning Rail with Fork in Position on Ball of Rail.

Above Operator is Shown Turning Rail with Fork in Position on Base of Rail.

Above Operator is Shown Turning Rail with Fork in Position on Web of Rail.

THE SAFETY RAIL FORK, the head of which is cast from a special alloy steel, to which is shrunk a hollow metal handle of ample strength, has been developed by a trackman with many years of practical experience.

The Fork Head is so shaped that the apertures will engage the BALL, WEB, or BASE of rail securely and in such a manner that the operator can, in every case, turn rail away from himself. As rail passes the balance point, the Fork is automatically released, thus eliminating any chance of injury to operator or other workmen.

Whether rail is piled in open or closed equipment or on the ground, and no matter what the method of piling may be, it is always possible to obtain a secure and safe grip on rail and to turn same without danger of injury to operator or others.

THE SAFETY RAIL FORK is made in three styles ONLY to accommodate all the commonly used rail sections, and in the great majority of cases, it will only be necessary for any one Railroad to purchase one type of Fork to take care of their various types of rail.

THE AMERICAN FORK & HOE COMPANY

General Offices: Cleveland, O. *Factory:* North Girard, Pa.

District Offices

Whitehall Bldg., New York, N. Y. — Daily News Plaza, Chicago, Ill.

Representatives at

Boston, Denver, Detroit, Minneapolis, St. Louis and San Francisco

Foreign Representatives

Wonham, Inc., 44 Whitehall St., New York, N. Y., and 68-72 Windsor House, Victoria St., London, S.W.-1

"STEAD"
TRUE TEMPER RAIL ANCHOR

Clamp and key are now shipped assembled which facilitates handling and simplifies application.

Initial and Application Costs Low

THE AMERICAN FORK & HOE COMPANY

General Offices: Cleveland, O. *Factory:* North Girard, Pa.

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Boston, Denver, Detroit, Minneapolis, St. Louis and San Francisco

Foreign Representatives

Wonham, Inc., 44 Whitehall St., New York, N. Y., and 68-72 Windsor House, Victoria St., London, S.W.-1

Announcing

2 *New* BETHLE H

▼

A new Heavy-Duty Steel Tie

▼

A Machine for taking Rail Contours

HEM PRODUCTS

Bethlehem has developed two new products of exceptional interest to maintenance of way Superintendents—a heavy-duty steel tie and a machine for taking rail contours.

They will be on view at the Exhibition of the National Railway Appliances Association, Booths 69½ to 72. Make it a point to see them. Bethlehem engineers will be there to point out the advantages of the new heavy-duty tie and to demonstrate the rail contour machine. There will also be exhibited new rail braces and the complete line of Bethlehem Trackwork, including switch stands, rail anchors, guard rails and gage rods.

If you are not going to the Convention you will want to know about this new heavy-duty tie and the rail contour machine. Write the nearest Bethlehem District Office for further information.

BETHLEHEM STEEL COMPANY, *General Offices:* Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis.

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Seattle, Portland, Honolulu.

Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.

See Them

at the

NATIONAL RAILWAY APPLIANCES ASSOCIATION CONVENTION

THE COLISEUM, CHICAGO

MARCH 10th TO 13th

BOOTHS 69½ TO 72

BETHLEHEM

The SELF-LOCKING

applied to track bolts and crossing frog bolts assures vibration-proof assembly without lock washers or jam nuts.

REMEMBER

Man hours are materially reduced in assembly of Dardelet bolts and nuts. Because of greater root area and form of thread, Dardelet threaded bolts are stronger in tension and shock than Standard V threaded bolts. Dardelet bolts and nuts are successfully heat-treated without affecting the locking action of the thread. The Dardelet Thread is **positively self-locking; adjustable and removable without injury to the thread; may be used repeatedly.**

To be exhibited by Bethlehem Steel Company at the Annual Exhibition of the National Railway Appliances Association

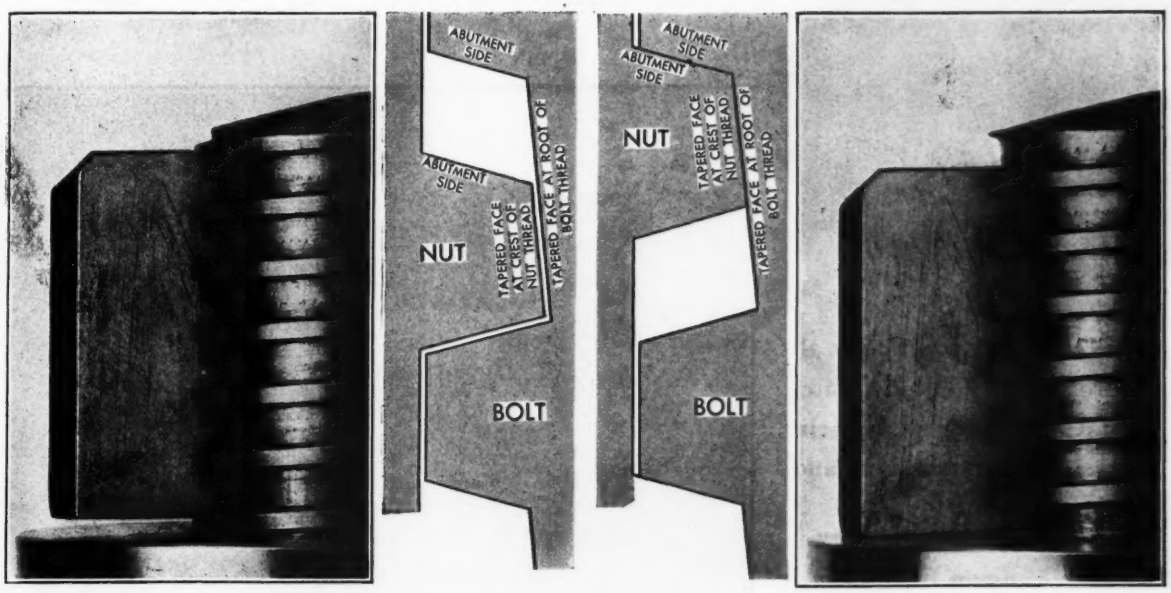
COLISEUM, CHICAGO
Booth 69½-72

*Patented in U.S.A. and Foreign Countries.

Manufactured and Distributed by Bethlehem Steel Company

Under License from the Dardelet Threadlock Corporation

DARDELET SCREW THREAD*



UNLOCKED **LOCKED**

THE LOCKING ACTION

The Dardelet Self-Locking Screw Thread locks solely by reason of the profile of the thread. The locking surfaces are the tapered faces at the root of the bolt thread and corresponding crest of the nut thread. There is a certain amount of end-wise play and the nut may be spun up to the work with the fingers. After the nut is seated against the work, a turn of an ordinary wrench forces the tapered face of the nut thread across the corresponding tapered face of the bolt thread until the abutment sides meet as shown in the locked position. In effect nut and bolt have become firmly wedged into one mass and they vibrate in unison when subjected to the jars and knocks of service. Vibration holds the maximum lock and tends to lock them tighter, yet when desired the nut can be readily adjusted or removed with an ordinary wrench without injury to the thread. Both bolt and nut can therefore be used repeatedly.

WRITE FOR DESCRIPTIVE LITERATURE

DARDELET THREADLOCK CORPORATION

120 BROADWAY NEW YORK, N. Y.

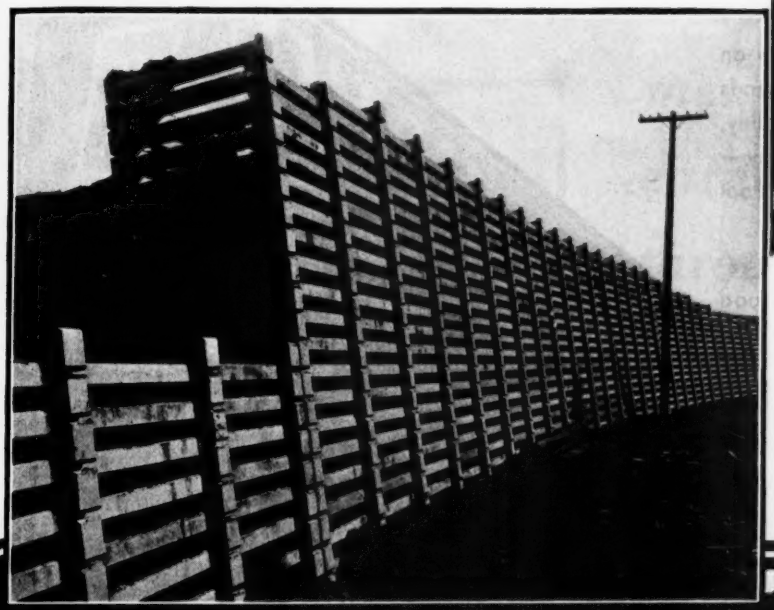
MAS

The choice of practically all railroads in United States and Canada for permanent culverts, cattle passes and drainage lines.

SALES OFFICES:
New York, Atlanta, Cincinnati, St. Louis, Los Angeles

MASSEY CONCRETE
Peoples Gas

SEY



The economical, convenient, and permanent wall for retaining any slope or supporting any embankment. Used by thirty-nine of the principal roads in the United States and Canada.

PRODUCTS CORPORATION
Building, Chicago

SALES OFFICES:
Canadian Concrete Products Co., Limited
Transportation Bldg.,
Montreal, Quebec

REM3-Graf

ONE PUNCH OF THE "START" BUTTON UNLOADS A WHOLE CAR

HERE is a good example of full-automatic coal handling . . . without the attention of a single operator.

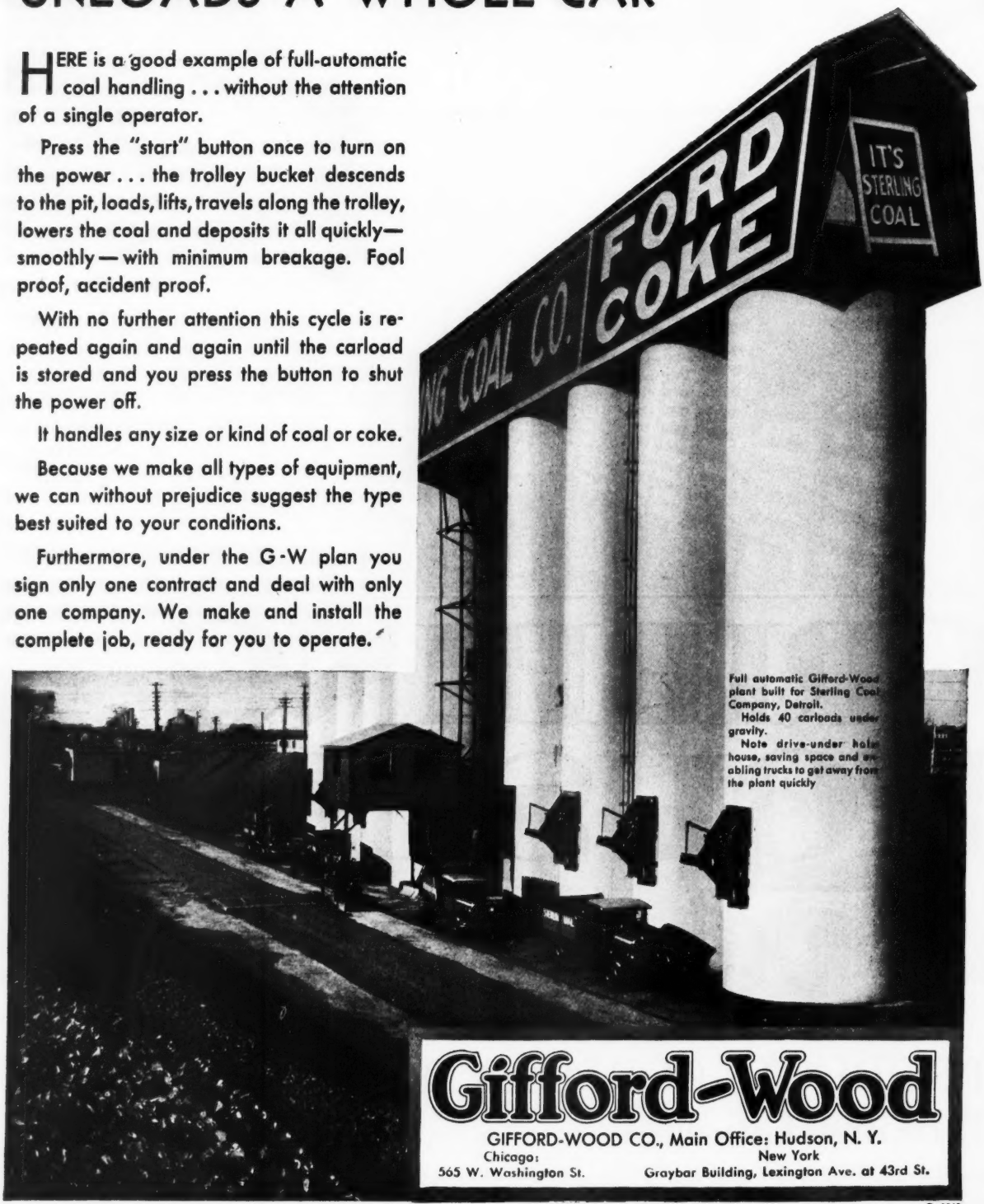
Press the "start" button once to turn on the power . . . the trolley bucket descends to the pit, loads, lifts, travels along the trolley, lowers the coal and deposits it all quickly—smoothly—with minimum breakage. Fool proof, accident proof.

With no further attention this cycle is repeated again and again until the carload is stored and you press the button to shut the power off.

It handles any size or kind of coal or coke.

Because we make all types of equipment, we can without prejudice suggest the type best suited to your conditions.

Furthermore, under the G-W plan you sign only one contract and deal with only one company. We make and install the complete job, ready for you to operate.



Full automatic Gifford-Wood plant built for Sterling Coal Company, Detroit.
Holds 40 carloads under gravity.
Note drive-under hole house, saving space and enabling trucks to get away from the plant quickly

Gifford-Wood

GIFFORD-WOOD CO., Main Office: Hudson, N. Y.

Chicago: 565 W. Washington St.

New York: Graybar Building, Lexington Ave. at 43rd St.

2242

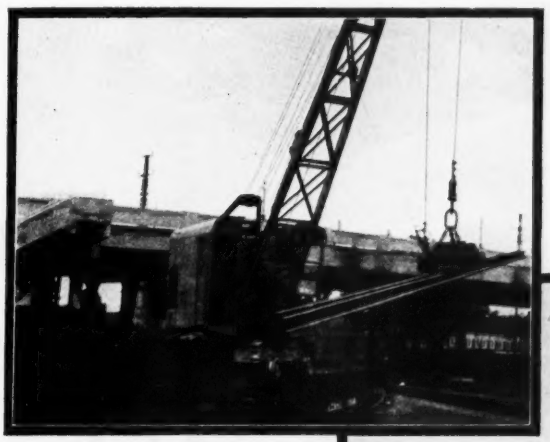
Model 20

BURRO CRANE

Model 30

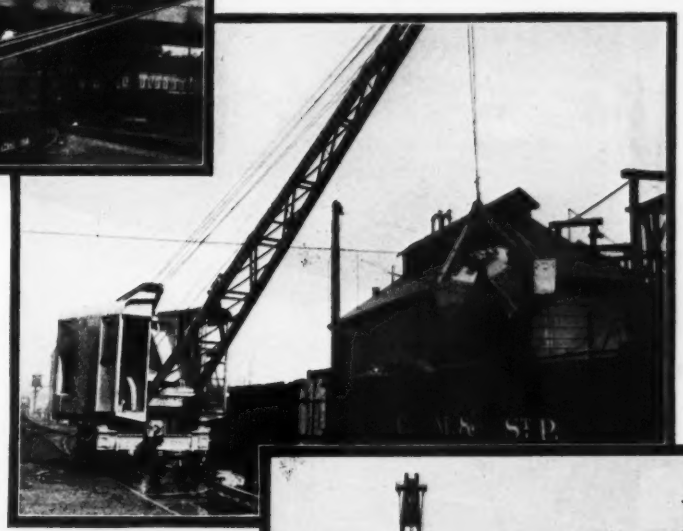
Countless Uses

mean tremendous earning power throughout the year

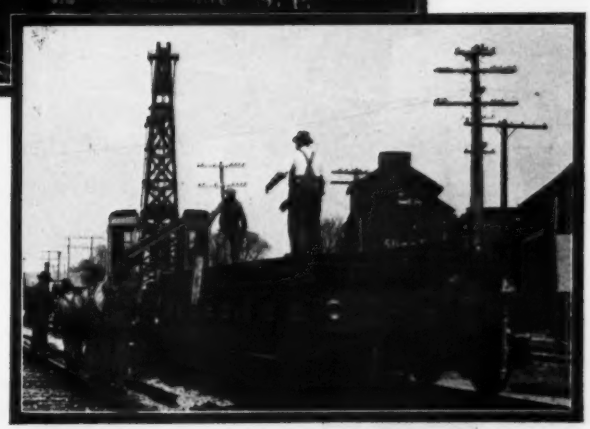


Above: Burro Crane equipped with 36" magnet operating on flat car.

Right: Burro Crane equipped with ½ yard clamshell bucket for handling bulk materials.



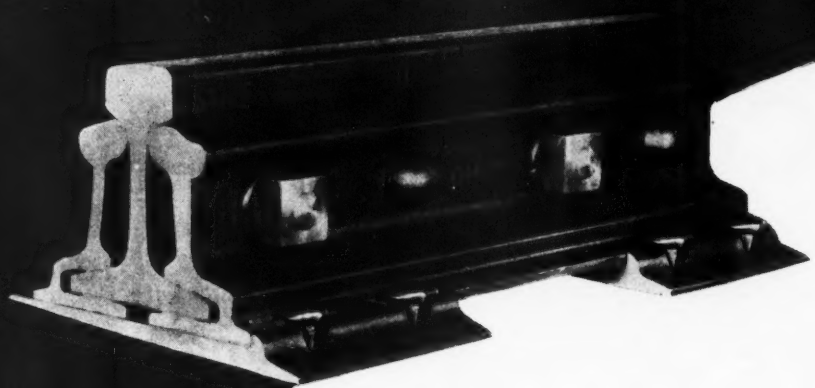
See Burro Cranes in motion pictures at the N. R. A. A. Exhibit Booths 116 and 117.



Loading changed out rail on a car which the Burro is hauling

Cullen-Friestedt Company, 1300 South Kilbourn Avenue, Chicago

BASE SUPPORTED R



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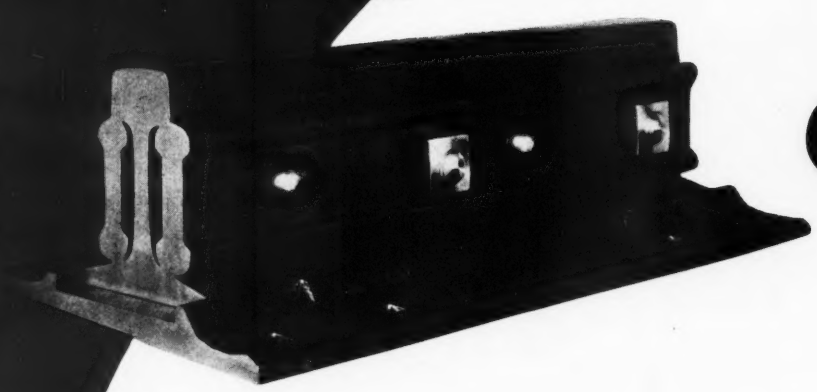
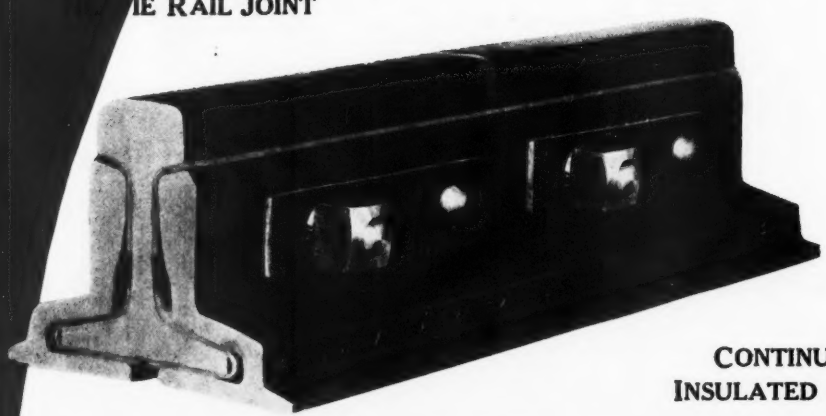


IE RAIL JOINT



CONTINUOUS
INSULATED JOINT

The Rail

RAIL JOINTS

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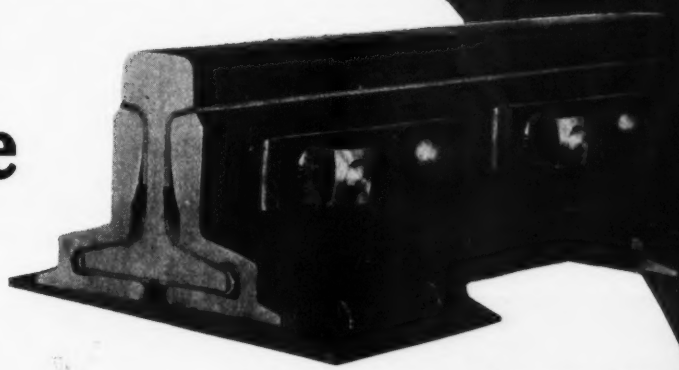
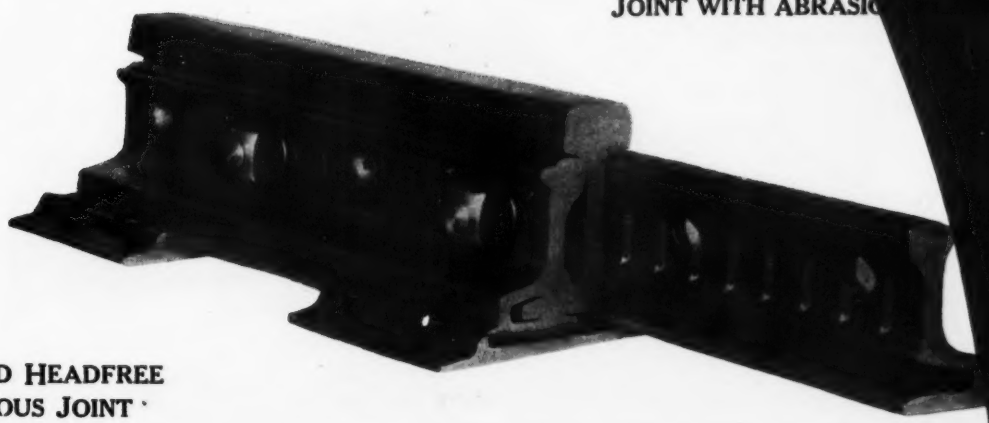
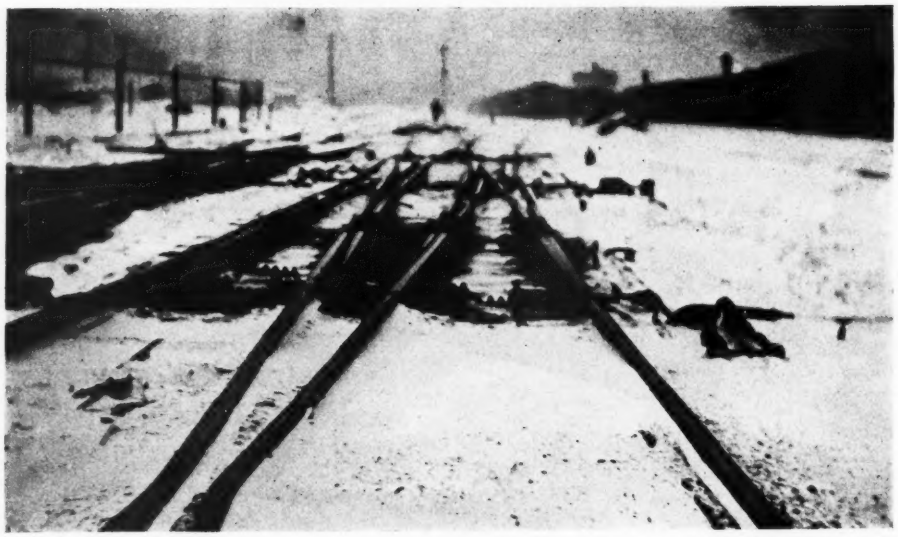


CONTINUOUS INS
JOINT WITH ABRASI



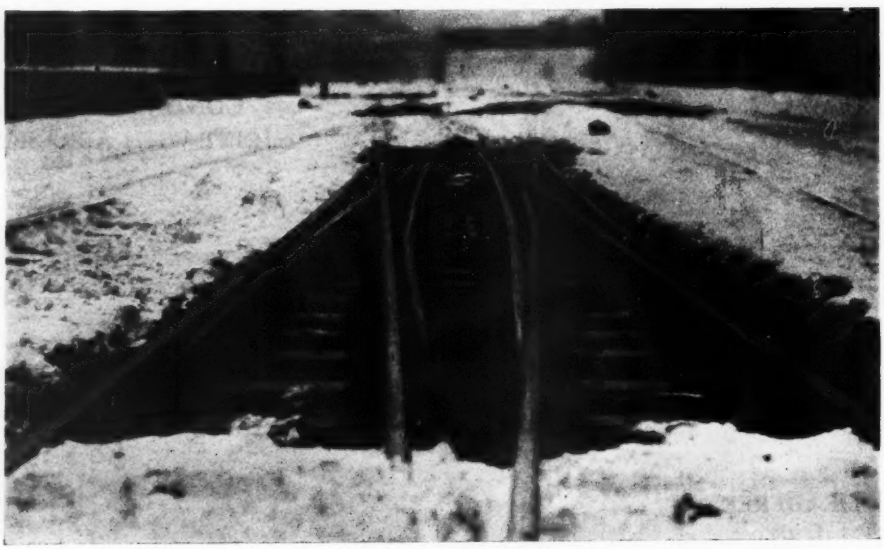
REINFORCED HEADFREE
CONTINUOUS JOINT

Vaughan Gas Switch Heaters for any Switch, Double Slip or Moveable Point Crossing



An 8 inch snow fall between 4 and 7 A. M. on the Erie R. R. Main Line, Croxton Yard, Jersey City; more than 1,000 Vaughan Switch Heaters kept this yard open and trains moving on time, without the help of brooms, shovels or oil pots

More than 30,000 Vaughan Gas Burners kept switches open and trains moving, without delay, through junctions and into terminals this winter.



Close view of double slip switch; Chicago Union Station, protected with Vaughan Gas Heaters. 14.8" snow-fall Dec. 18-19, 1929. Sufficient heat radiated from rails to melt all snow and ice.

RUBY RAILWAY EQUIPMENT COMPANY

Real Estate Trust Building, Philadelphia, Penna.

HUBBARD & COMPANY

Super Steel Track Tools and Nutlocks
Track Chisels—Spike Mauls—Sledges—Adzes

Made from an alloy steel
of our own special analysis
and
guaranteed

YOU ARE INVITED
to call and inspect
Track Tools Manufactured According
to the proposed new A. R. E. A.
Specifications at our Exhibit

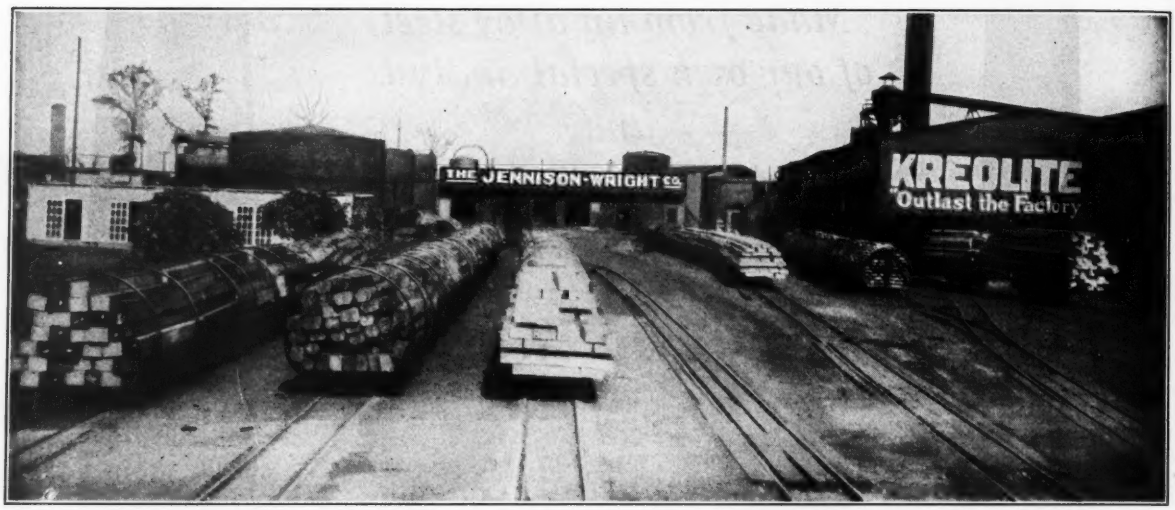
BOOTH No. 86—COLISEUM

HUBBARD & COMPANY

Tool Department

Pittsburgh - Pennsylvania

KREOLITE



We Distill Our Own Creosote Oil

By so doing it is possible for us to insure to the purchaser a uniform pure product of any grade desired. We have treated hundreds of millions of feet of timber in the past 17 years without a single instance of decay.

By the installation of the latest and most modern framing and boring machinery, we assure the purchaser of timbers most accurately framed at lowest cost.

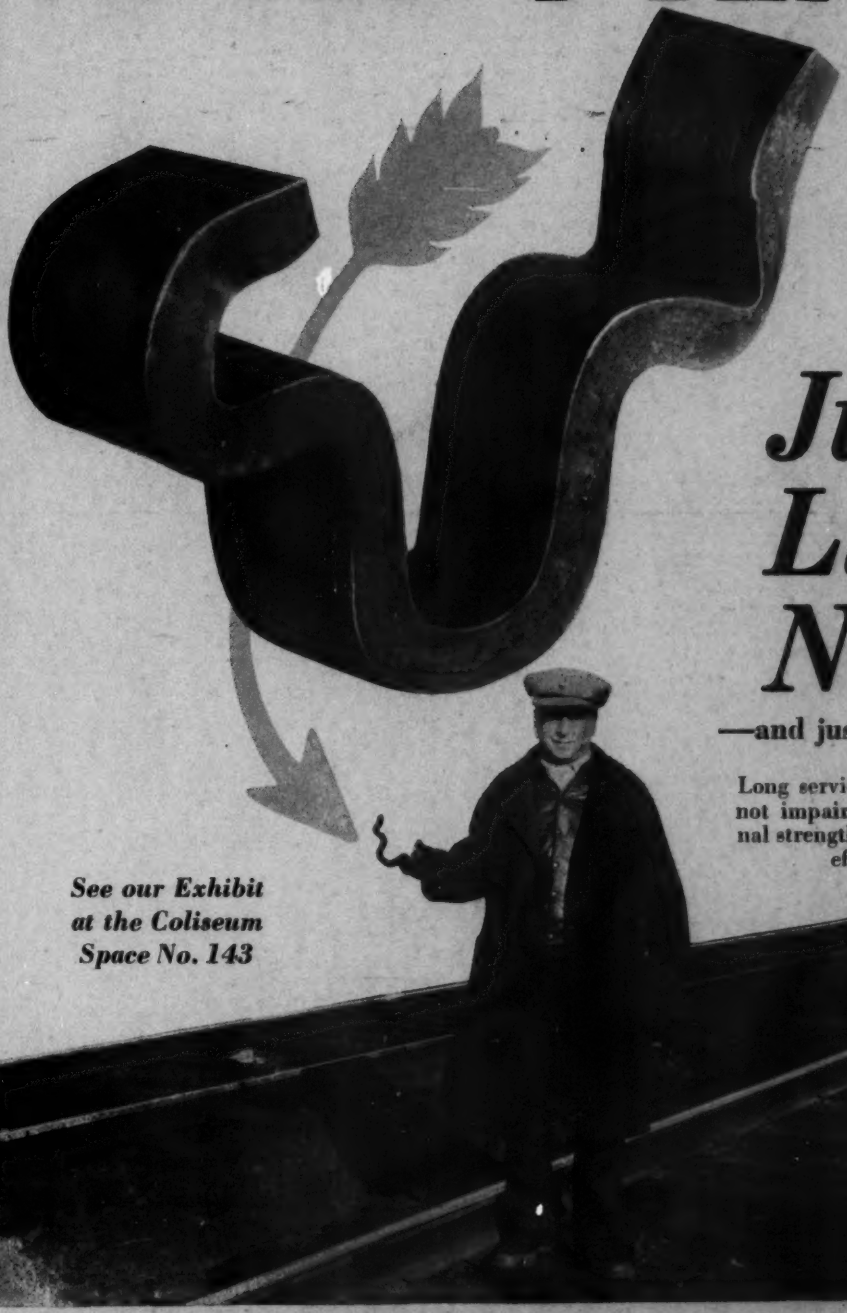
Enormous stocks of Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant at Granite City, Ill., (East St. Louis).

THE JENNISON-WRIGHT COMPANY, Toledo, Ohio

Branches in All Large Cities

R.R. TIES

AFTER 4 YEARS



Just Like New

—and just as powerful

Long service in track does not impair its great original strength, resiliency and efficiency

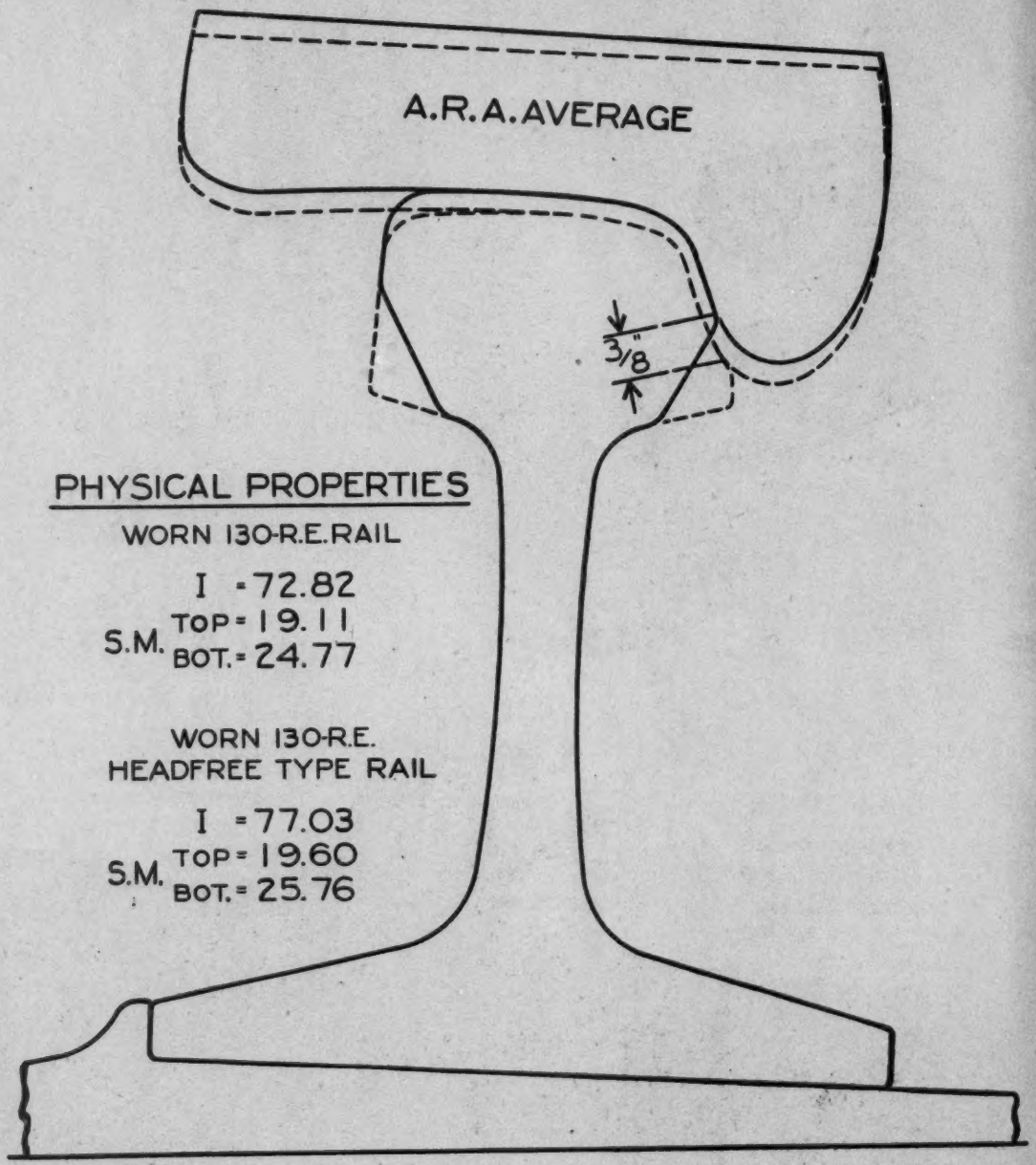
See our Exhibit at the Coliseum Space No. 143

WOODINGS FORGE & TOOL CO.

WORKS AND GENERAL OFFICES

VERONA, PENNA.

Headfree Rail In Service



PHYSICAL PROPERTIES

WORN 130-R.E. RAIL

I = 72.82

S.M. TOP = 19.11

S.M. BOT. = 24.77

WORN 130-R.E.
HEADFREE TYPE RAIL

I = 77.03

S.M. TOP = 19.60

S.M. BOT. = 25.76

PATENTED IN THE
UNITED STATES AND
CANADA

THE THOMSON RAIL CO

PENNSYLVANIA BUILDI HILA

rvice Meets Every Claim

RAIL contours on opposite page show 130 RE (HEADFREE TYPE) section and standard 130 RE section after carrying over 17,000,000 tons. These rails, laid the same time, in the same 7 degree 28 min. curve, show how differently wear takes place, in view of the fact that EACH RAIL HEAD HAD .37 SQUARE INCHES ABRADED from the head of original sections.

Note the ⅜" less wheel flange bearing on the HEADFREE RAIL provides a rolling friction as compared to the sliding friction on the standard section. This in turn means LESS TRAIN RESISTANCE. The O G. curve on the standard section shows the starting of the ledge on which the tips of the wheel flange will soon ride. FLANGEFREE IS ANOTHER TERM WE NOW USE IN CONNECTION WITH HEADFREE RAIL.

Note how much better the HEADFREE RAIL maintains gauge.

Note how the properties of the two worn sections bring out the greater Inertia (stiffness) of the HEADFREE RAIL still remaining.

Even if you should abrade a standard rail head 2 square inches the ½ sq. inch which is added on the top of the HEADFREE section gives 25% more area of wear, the economies of which can be easily figured from an operating, maintenance and motive power point of view.

IN RAIL BUYING, SO MANY THOUSAND TONS OF INERTIA SHOULD BE THE CONSIDERATION RATHER THAN SO MANY THOUSAND TONS OF STEEL.

License to roll Headfree Rail may be had by Railroads from The Thomson Rail Corporation of New York

OPORATION OF NEW YORK

DIN HILADELPHIA

The barrier
YIELDS...
The vehicle
STOPS...
Lives are
SAVED...

When The HIGHWAY GUARDIAN protects a crossing!

GRADE crossing safety such as THE HIGHWAY GUARDIAN provides became practical when a yielding snubber was perfected. As a train approaches, a protecting barrier starts to lower. In a few seconds it places a barricade of steel across the highway, its outer end locking over the engaging post of a powerful snubber.

An on-coming motorist, disregarding warnings crashes into the barrier. Instead of crashing through it, a wire rope of great strength engages the front of the car. The force of the impact is transmitted to the snubber which immediately softens the blow. It yields, the vehicle continues forward a few feet, but gradually and positively the snubber overcomes all forward movement and brings the vehicle and passengers safely to a stop. With the danger passed, the barrier automatically rises allowing traffic to proceed. The snubber, returned by hydraulic pressure to its starting position, is ready for the next irresponsible driver.

From both mechanical and safety standpoints, two years of severe testing have proved THE HIGHWAY GUARDIAN a thorough and reliable crossing safeguard. Installation requires no change in existing grades or interference with signal systems. In operation THE HIGHWAY GUARDIAN has been raised and lowered 250,000 times, the equivalent of more than 14 years service on a railroad having 50 trains every 24 hours, and shows no appreciable sign of wear. Maintenance amounts to practically nothing.

How THE HIGHWAY GUARDIAN operates is interestingly told in Bulletin No. 750. Write for a copy.

At the moment of contact with the barrier the wire rope gives an even bearing against the car. The snubber has not started to act.

Compare the position of the snubber in this picture with its position in the illustration above. Here the snubber has moved to take up the shock.

The fundamental idea from which THE HIGHWAY GUARDIAN has been developed was the ingenious conception of Mr. Joseph Strauss, eminent consulting engineer and builder of many of the world's famous bridges

Franklin Railway Supply Company, Inc.

New York Chicago St. Louis San Francisco Montreal

On the Southern Pacific

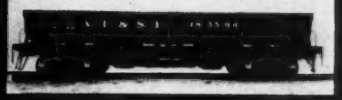
On the Boston & Maine

On the Frisco

FOR
SERVICEABILITY
AND
INVESTMENT ECONOMY

On the Great Northern

On the Santa Fe



On the E. J. & E.

On the A. C. & Y.

MAGOR Air Dump Cars are known throughout the world for their ability to stand the hard knocks and terrific punishment of loading and unloading. They are big and rugged and yet the smoothest in point of operation.

The extra built-in strength gives the owners every advantage of sustained operation, added years of dependable service, minimum upkeep cost and the highest return on their investment.

Magor Air Dump Cars are dependable and economical for the following very good reasons:

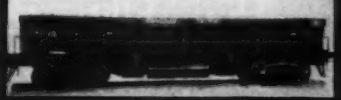
Strong Underframe and Body
Stability on Track
Violent Shocks Eliminated
Cannot Dump Prematurely
Selective Dumping
Free Floating Door
Low Loading Height
Dump Clear of Track Ballast
Meet A. R. A. and I. C. C. requirements.

. Here is a dump car that merits investigation. Ask for full details.

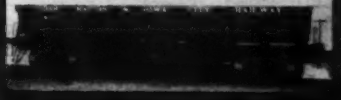
Magor Car Corporation
50 Church St., New York

On the New York Central

On the C. P. R.



On the Cedar Rapids Ry.



On the M. & E.

MAGOR CARS

Specify NORTHWESTERN

IN BACK OF THE NAME NORTHWESTERN and Casey-Jones is an alert organization skilled in the art of designing and building motor cars and equipment for safe and rapid transportation of maintenance gangs . . . and for mechanical maintenance work.

With more than twenty years of successful manufacturing experience this complete organization, ample and economic, steadily expanding its facilities and knowledge stands today ready to serve the railway field with a modern and quality product, outstandingly recognized as the standard of value.

The ability to provide the proper type of car for every class of service is a fact worthy of consideration by every railway ⁂ with assurance of the most practical and efficient design ⁂ the most satisfactory performance ⁂ reasonable cost of replacement parts ⁂ and the best investment at any price ⁂ lowest cost per mile ⁂ for years and years.

SEND YOUR INQUIRIES TO OUR NEAREST OFFICE

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Goodell & Hoppe
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Koppel Industrial Car & Equipment Co.
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Casey Jones

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SEND YOUR INQUIRIES TO US AND CREATE A BETTER SOURCE OF SUPPLY FOR ALL MOTOR CAR MATERIAL

THE RIGHT TYPE OF CAR FOR EVERY CLASS OF SERVICE

CLASS	TYPE		H. P	CAPACITY	SERVICE
CLASS A	Casey Jones	561	40	4 TO 200 MEN -- TRAILERS	HEAVY DUTY
CLASS A		561-H	40	24 MEN -- SEATED	HUMP SERVICE
CLASS A		561-D	40	10 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A		561-T	40	10 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A		565	40	14 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A		570	40	5 MEN -- ENCLOSED	INSPECTION SEDAN
All Types Above Equipped With New Model "A" Ford Motor 40 H. P. Self Starter					
CLASS A		551	22	4 TO 150 MEN -- TRAILERS	HEAVY DUTY
CLASS A		551-H	22	20 MEN -- SEATED	HUMP SERVICE
CLASS A		551-T	22	8 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A		551-D	22	6 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A		555	22	12 MEN -- ENCLOSED	OFFICIAL INSPECTION
All Types in 551 Series are Equipped With Model "T" Ford Motor 22 H. P.					
CLASS B		523	8	2 TO 60 MEN -- TRAILERS	ALL SECTION SERVICE
CLASS B		523-CS	8-16	2 TO 120 MEN -- TRAILERS	WEED MOWING
Type 523-CS is Equipped With Speed Reduction Countershafts					
CLASS C		531	4	1 TO 4 MEN	LIGHT INSPECTION

MODERN MOTOR CAR EQUIPMENT for EVERY PURPOSE

DISCER		581-A	40	ALL DISCING WORK	BALLAST IMPROVEMENT
TRAILER		562		24 MEN -- SEATED	MOVING LARGE GANGS
PUSH CAR		500		6000 POUNDS	WORK CAR

HYATT - TIMKEN - BOWER ROLLER BEARINGS FOR AXLES WITH DIAMETERS FROM 1" TO 3"
MOTOR CAR FRAMES AND CHASSIS OF ALL TYPES - SPECIAL MOTOR CARS - MOTOR CAR ENGINES 4-6-8 HORSEPOWER - REPLACEMENT AXLES AND BEARINGS - EQUIPMENT

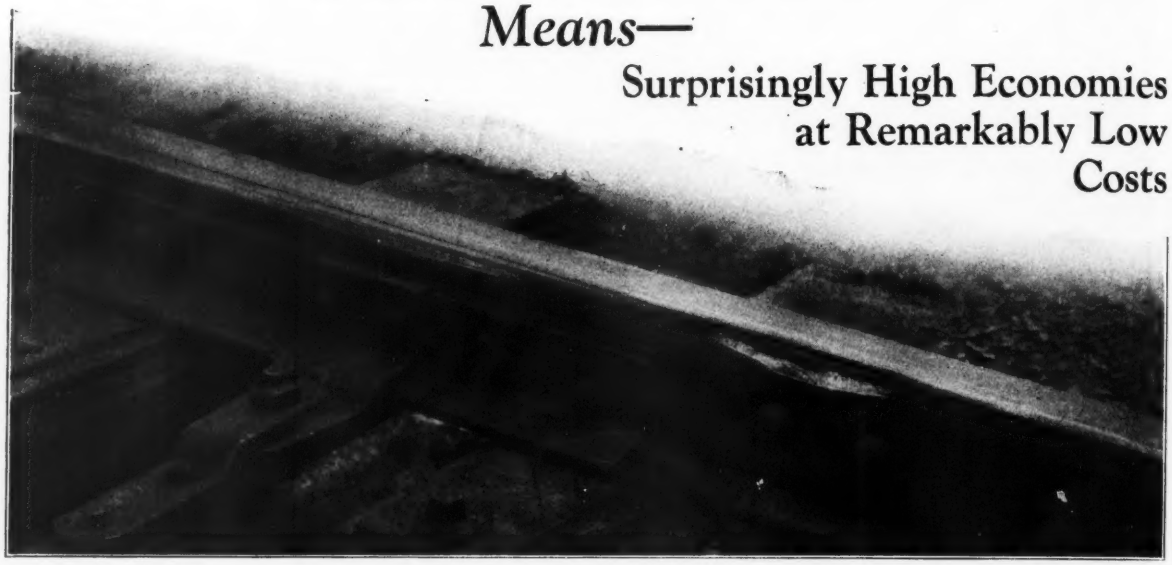
NORTHWESTERN MOTOR COMPANY

FACTORY AND GENERAL OFFICES: EAU CLAIRE, WISCONSIN

"MACK" Switch Point PROTECTION

Means—

Surprisingly High Economies at Remarkably Low Costs



The "MACK" SWITCH POINT PROTECTOR With Its Reversible Feature

1. Increases 5 to 10 times the life of switch rails.
2. Helps to prevent derailments.
3. One man can reverse or replace an inexpensive Mack Switch Point Protector in a few minutes—But it takes several men and a lot of time to replace a costly switch rail.
4. Write for additional description or make out a requisition for enough "Mack" Reversible Switch Point Protectors to equip your most used switches.

Manufactured by

The Fleming Company, Scranton, Pa.

Sold Exclusively by

THE MAINTENANCE EQUIPMENT COMPANY

1305 Railway Exchange :: Chicago, Illinois

NEW YORK CLEVELAND SAN FRANCISCO ST. LOUIS

Curve Friction Outwitted

Always on the job—day or night—winter or summer—in storm or fair weather—

THE MECO RAIL AND FLANGE LUBRICATOR

Lubricates the curves ahead—reduces derailment danger—practically banishes rail and flange wear—makes possible increased tonnage ratings—increases safe speed limit.

Jackson Power Track Ballasters
3 man rail layers hand operated
3 man rail layers power operated
Richter Blue Flag derails
Meco Rail and Flange Lubricator
Derrick Rail and Flange Lubricator
Mack Switch Point Protector
Breyley Friction Car stops
Power Ballast Screen

LABOR SAVING TRACK DEVICES

Manufactured by

The Fleming Co.
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THE MAINTENANCE EQUIPMENT CO.
Railway Exchange, Chicago, Illinois

STOP!

Q AND C

at Booths 120 and 139

and see The Maintenance Exhibit of the Convention

The Q & C Company will exhibit the following devices:

Heel Bolts
Rail Tongs
Spike Setter
Foot Guards
Flangeway Guards
Guard Rail Clamps
Switch Point Guards
Hand Throw Derails
One Piece Manganese Guard Rails
Self Adjusting Sliding Type Derails
Rolled Steel Step Joints
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Don't fail to see the latest labor saving device on the market—The Q & C Spike Setter designed to eliminate setting spikes by hand.

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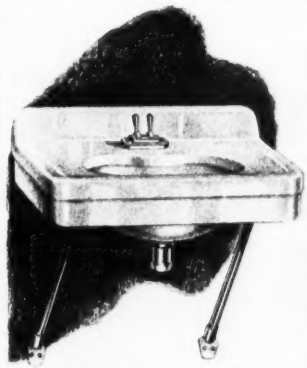
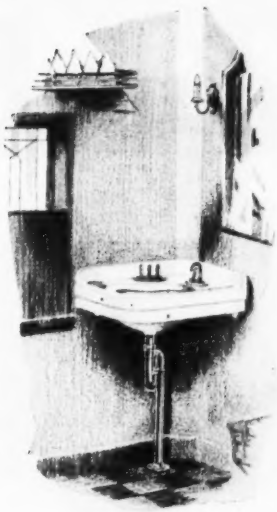
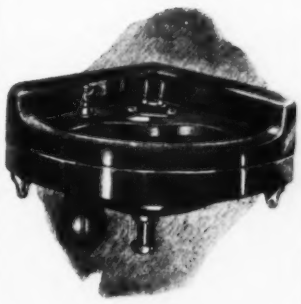
Constant Progress Makes Better Railroading



YELLOWSTONE



NIAGARA



GLACIER

A department organized to serve you

YOUR needs—your problems—your most exacting requirements—are cared for by a special department of this company.

In this department you will find a personnel admirably equipped to serve you. Courtesy, promptness and a thorough knowledge of the railway field are a part of the service it will give you, no matter how small or how large your order.

This company has been for more than a quarter century the leading manufacturer of fine plumbing fixtures. Its products are found in more homes than those of any other maker. Its record in equipping public buildings, institutions, some of the country's largest railroad buildings, and innumerable office buildings, is a notable one from every point of view.

"Standard" has pioneered in developing the vitreous china fixture for railway use—believes in it—advocates its use for sanitary reasons—and considers it the ideal material for this purpose. It is more durable than porcelain, more beautiful and much more easily cleaned than metal, and it is supremely sanitary.

In the regular "Standard" lines, you will find Plumbing Fixtures for every railway need—for stations, office buildings, shops, roundhouses, etc. No other line is more complete, of finer design or of higher quality.

"Standard" invites you to consult with this department at any time. Simply address

Railroad Fixture Department

Standard Sanitary Mfg. Co., Pittsburgh

Division of

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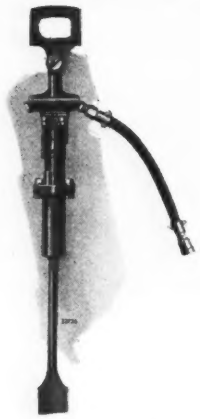
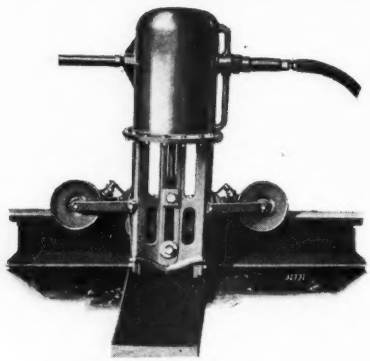
"Standard"
PLUMBING FIXTURES

THE LARGEST MANUFACTURER OF PLUMBING FIXTURES IN THE WORLD

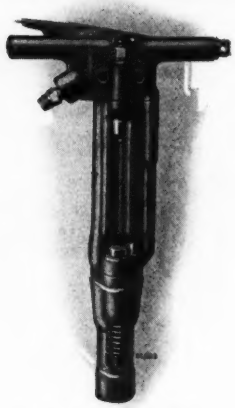
Labor Aiding Pneumatic



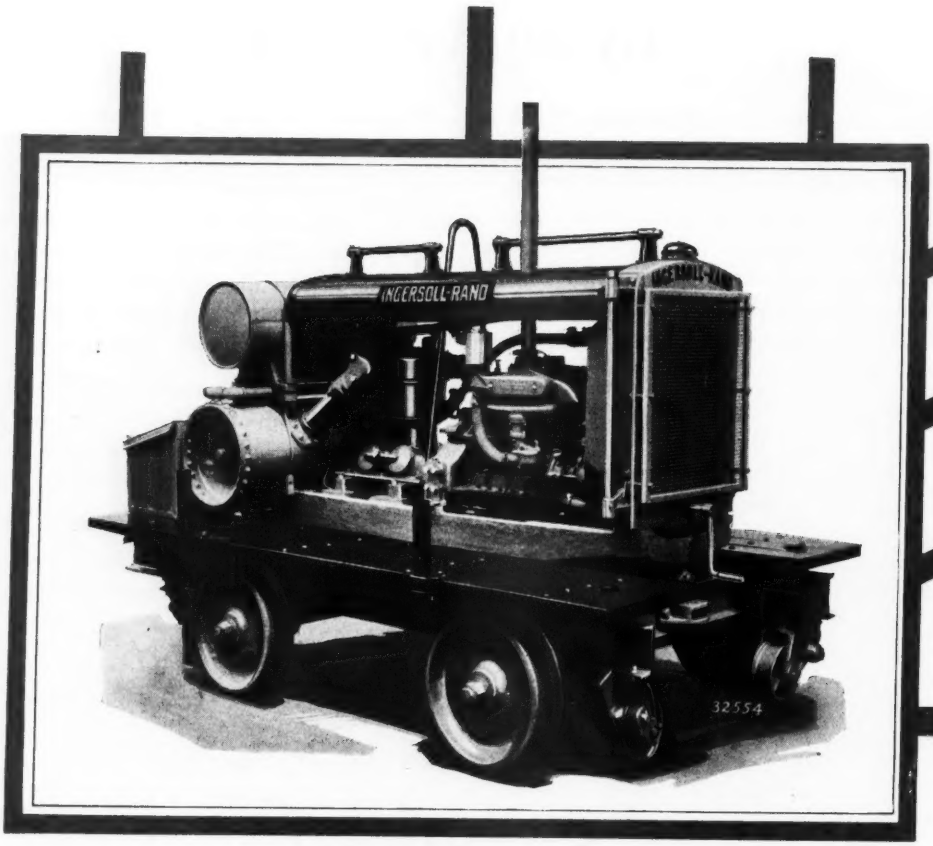
MT2 Tie Tamper—tamps track that stands up 2 to 3 times as long as that tamped by hand.



Size SP9 Spike Puller—pulls spikes at the rate of 8 to 10 a minute.

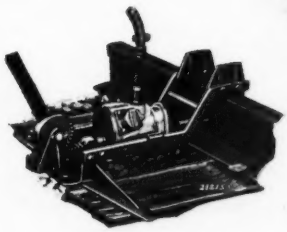


Size CC250 Spike Driver—drives a straight spike in 5 to 6 seconds.

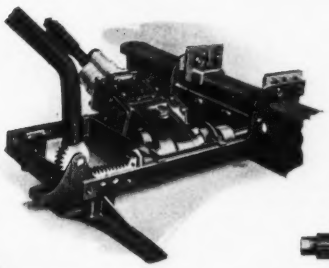


Size 5½"x5" Tie Tamper Compressor—equipped with the latest type wheels, cross-trucks, hand rails, air aftercooler, etc. These compressors are available in four sizes, which will operate respectively, four, eight, twelve, and sixteen tamper.

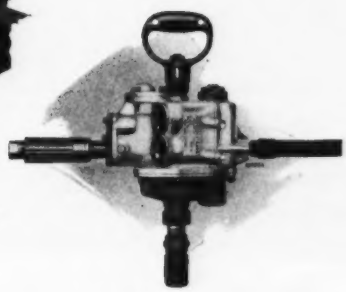
Tools for Track Work



Size D Bonding Drill—drills a 9/16" bond hole in 15 seconds.



Size 90 Rail Drill—drills a 7/8" hole through web in 30 seconds.



Size CCW Woodborer—drills a screw spike hole in 6 seconds.

Seven ways to save labor

The tools shown here indicate several operations on which economies are possible by the use of Ingersoll-Rand pneumatic equipment. In addition, we have a complete line of pneumatic hammers, rivet busters, metal drills and reamers, saws, demolition tools, and rock drills. Each of these tools is a proven labor and time saver on its particular class of work.

At the A.R.E.A. Convention be sure to visit our exhibit in the Coliseum, Booths 206-207-208-209; or ask for literature describing the complete line.

INGERSOLL-RAND CO. - 11 BROADWAY - NEW YORK CITY

Branches or distributors in principal cities the world over

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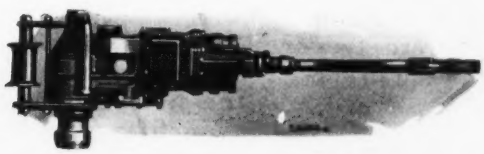
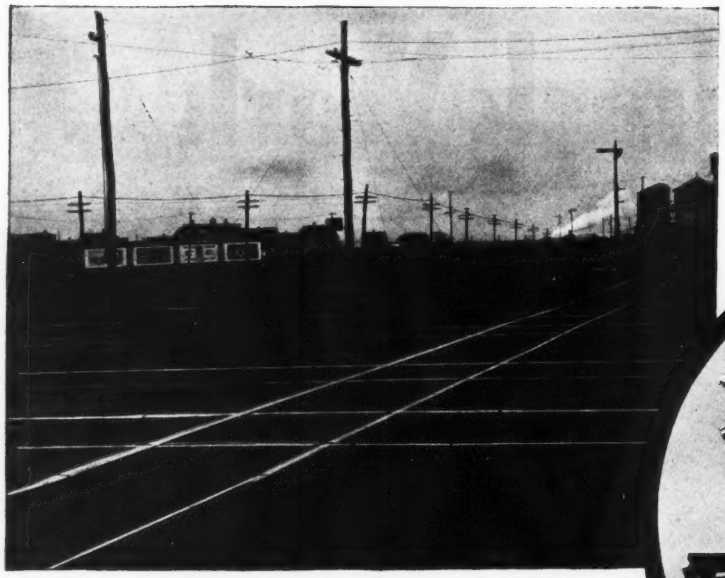


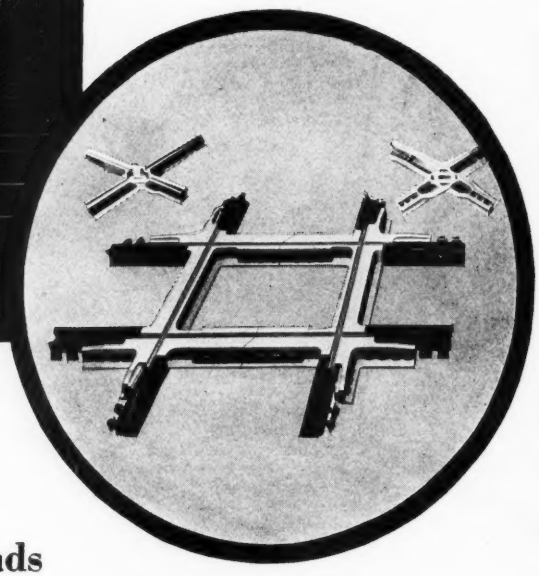
Size 99C Track Wrench—bolts up track 10 times faster than hand methods.

275-TT

Ingersoll-Rand



The New WHARTON crossing at Elizabethport, New Jersey



Now cutting maintenance costs on over fifty leading railroads

The New Scientifically Designed WHARTON Crossing

CROSSING maintenance is no longer an indeterminable item with the many leading railroads that have adopted the NEW scientifically designed Wharton crossing.

For these roads no longer depend on crossings whose designs are not based on an accurate knowledge of their reaction to the severe stresses imposed in service.

The New WHARTON Crossing is the first scientifically designed crossing—the result of a long engineering study which has at last determined the proper design and distribution of metal to withstand the stresses encountered under severest operating conditions. In addition, it is made of dependable TISCO Manganese Steel.

You will want to learn more about the design of this proven crossing—and the service it is giving on the tracks of over fifty of the leading Steam and Electric Railway Companies. Write for bulletin 1 C.

Guard Rail Clamps

—

Insulated and Non-Insulated Gauge Rods

—

Wharton-O'Brien Insulated and Adjustable Pull and Lock Rods

William Wharton Jr. & Co., Inc.

EASTON, PENNSYLVANIA

SALES OFFICES: **PITTSBURGH CHICAGO HOUSTON MONTREAL NEW YORK PHILADELPHIA BOSTON SAN FRANCISCO SCRANTON LOS ANGELES**

Kalamazoo 23 Motor Car Has Made a BIG Place for Itself on Many Railroads

KALAMAZOO *Means Service To You*

Proven Through Service

Kalamazoo Motor Car "23" through many years of service on many railroads has proven especially valuable for section work, bridge gang work, and telegraph line construction.

Very flattering reports are constantly coming in to us on its exceptional utility and low maintenance and operating cost.

Full catalog information on request.

Kalamazoo Railway Supply Co.

Manufacturers—Established 1883

Kalamazoo, Michigan, U. S. A.

ANOTHER TRIUMPH OF GENERAL ELECTRIC RESEARCH!

G-E-Glyptal Lacquers

REG. U. S. PAT. OFF.

INDUSTRY'S LIQUID ARMOR

G-E Glyptal Lacquers are *more than paint.* They protect and seal—tanks, pipe lines, motors . . . machinery, structural steel . . . the list is endless, in every industry.

Long-run cost is less because they need no primer, no sizer . . . one glossy coat does the work of two.

Their tough, flexible film prevents rust, withstands heat, alkalies, weak acids, salt spray, mineral oils. And it *lasts.*

Applied with spray-gun, brush or dip-tank these lacquers dry dust-free in 30 minutes! Save time and labor.

G-E Glyptal Lacquers *modernize* industrial painting. Let them modernize *yours*—beginning NOW!

G-E Merchandise Distributors everywhere can tell you about G-E Glyptal Lacquers—or write Section M-893, Merchandise Department, General Electric Co., Bridgeport, Conn.

(Join us in the General Electric Hour. Saturday at 9 p.m. Eastern Standard Time, N.B.C. Network).

ALL SIZES

Half-pint cans to 52-gal. drums.

COLORS

Red	No. 1201
Clear	" 1202
Blue	" 1206
Black	" 1209
Brown	" 1210
Green	" 1211
Aluminum	" 1212
Gray	" 1214
Gray	" 1217

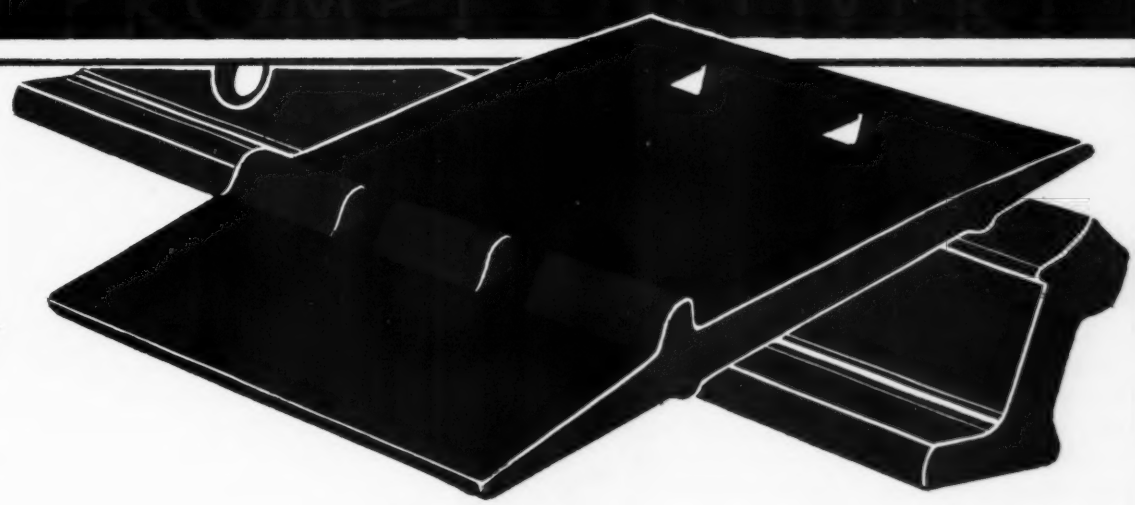
GENERAL ELECTRIC

GLYPTAL LACQUERS

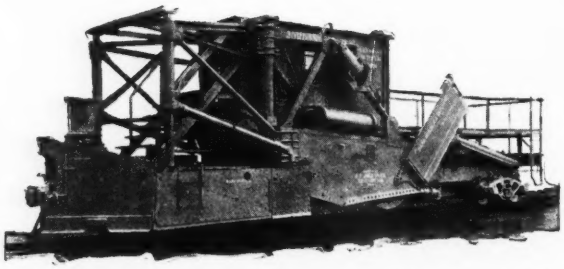
MERCHANDISE DEPARTMENT - GENERAL ELECTRIC COMPANY - BRIDGEPORT, CONNECTICUT

TIE PLATES

ANGLE BARS



The location of Illinois Steel Company's plants . . . in the Chicago Metropolitan District . . . assures prompt delivery to your railroad. . . . . A technical knowledge of track maintenance, coupled with long steel-making experience, assures dependable products. . . . . The result of that combination of location and products is the type of service every railroad likes to receive.



CAST STEEL WINGS TELESCOPIC BRACES

NEW JORDAN TYPE "A" SPREADER-DITCHER

Meets Every Railway Spreading and Ditching Requirement

JORDAN SPREADER
"Does the Work of an Army of Men"
SNOW PLOW ICE CUTTER
UNIVERSAL
STANDARD
DITCHER
O.F. JORDAN COMPANY
WALTER J. RILEY, PRESIDENT
EAST CHICAGO, INDIANA

O. F. JORDAN CO. East Chicago, Indiana

Walter J. Riley, President

. . THE DADDY OF THEM ALL! . .

This 23 year old ARMCO Culvert

is rounding out another winter of faithful service

THE pictured Armco Culvert was installed in 1907 under the main line of the C. R. I. & P. Railroad, between Minneapolis and Kansas City. Season after season, in cold weather and warm, thousands of tons of traffic have rolled over it. Its strength has been—and continues to be—remarkable. Freezing, even while water-filled, has left it unharmed!

As to durability of the metal, no other corrugated metal culvert has endured so long in the soil—in "Nature's laboratory"—where tests are made impartially and fairly.

Safety to the traffic it supports is the primary warranty that goes with every Armco Culvert installation. Safety, measured by continuous, trouble-free service over a long period of years. Safety that also saves on the investment, for Armco Culverts, so durable, cost less in the long run.

Many thousands of Armco Culverts have been in service since 1906. Today, 50,000,000 feet of Armco Culverts attest the confidence reposed in them by the railroads of the United States and Canada.

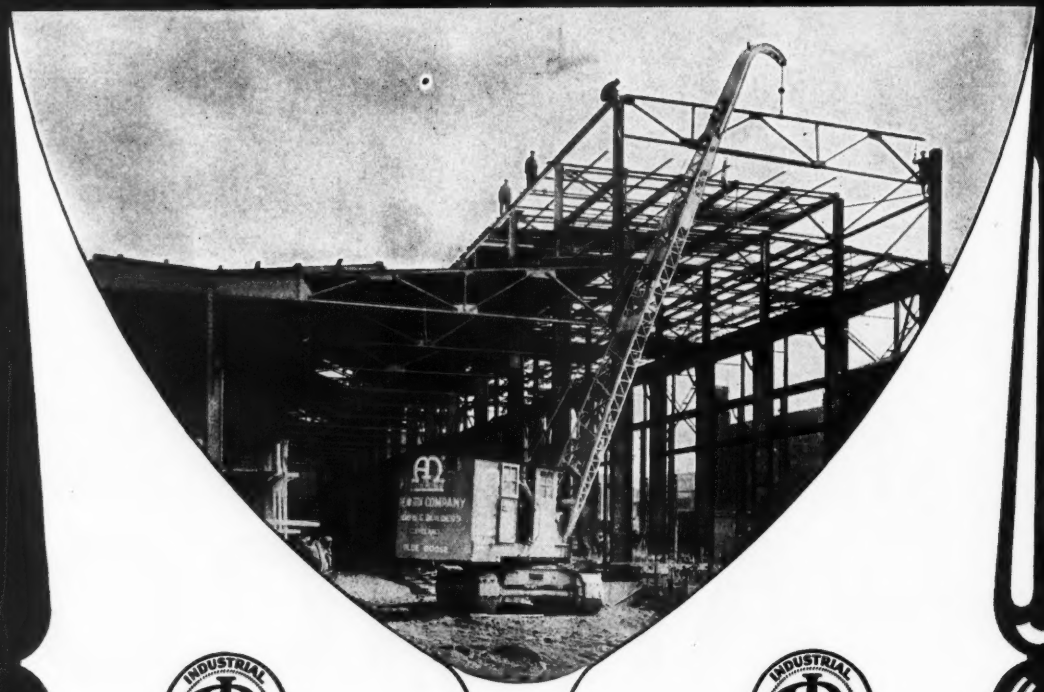
Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand.

ARMCO CULVERT MANUFACTURERS ASSOCIATION

Middletown, Ohio

REM3

When Time Means Money



The Austin Company does not hesitate to make a contract which provides a penalty clause for the non-completion of a job within a remarkably short time. And they invariably make good because they have an efficient organization, backed up by dependable equipment.

Included in this equipment are five Industrial Brownhoists, the last of which was recently sold to The Austin Company of Texas for use on railroad terminal and hangar work. These crawler cranes are among the first units on the job and are put to work in the unloading, handling and erection of materials. When their work is done, they are easily loaded and shipped to the next job because no dismantling is necessary.

The Austin Company, and many other of the country's leading organizations, are fleet owners of Industrial Brownhoists because they have found that they pay big returns and that their better construction makes them absolutely dependable. There is a size and type that would be equally as efficient on your work.

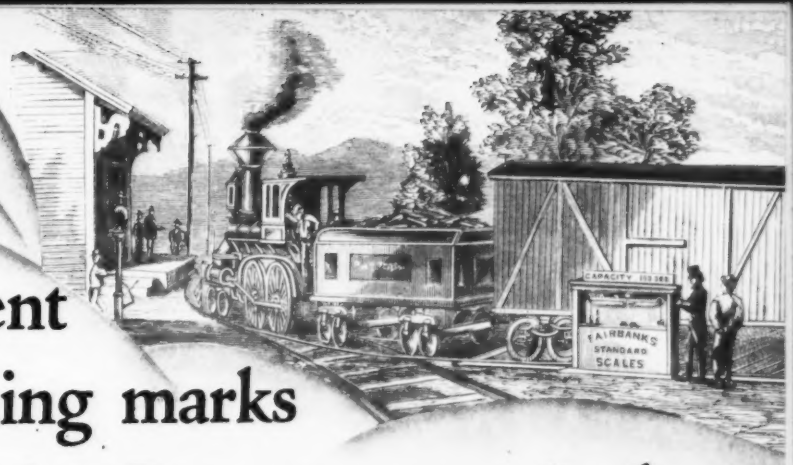
Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco, Cleveland

Plants:

Brownhoist Division, Cleveland; Industrial Division, Bay City, Michigan; Elyria Foundry Division, Elyria, Ohio

The Choice of Leading Engineers



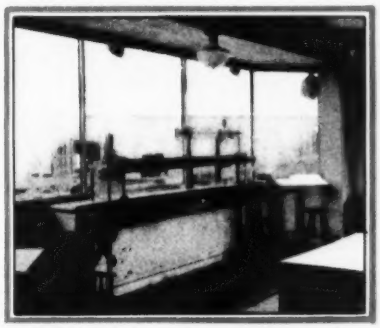
New achievement in railway weighing marks

Fairbanks' Centennial

WHISKERED spectators looked on while a locomotive, belching wood smoke from a queer-shaped funnel, pushed a freight car upon a new type of scale. Thaddeus Fairbanks had introduced the first railway track scale in the United States! In 1857 a patent on this railway scale was granted to the ingenious Yankee who, in 1830, had conceived the system of weights and levers which is the foundation of every modern scale.

Since those early days remarkable progress has been made in building railway equipment. Gigantic locomotives develop power and speed that few men of that pioneer era dared to predict. Loads that would tax the capacity of an early-day train are now accommodated in a single car. Increasing weight of rolling stock has called for improved weighing methods and heavier scales. The fact that Fairbanks Scales are used on almost every railroad in the world is eloquent testimony that Fairbanks has met the requirements most successfully.

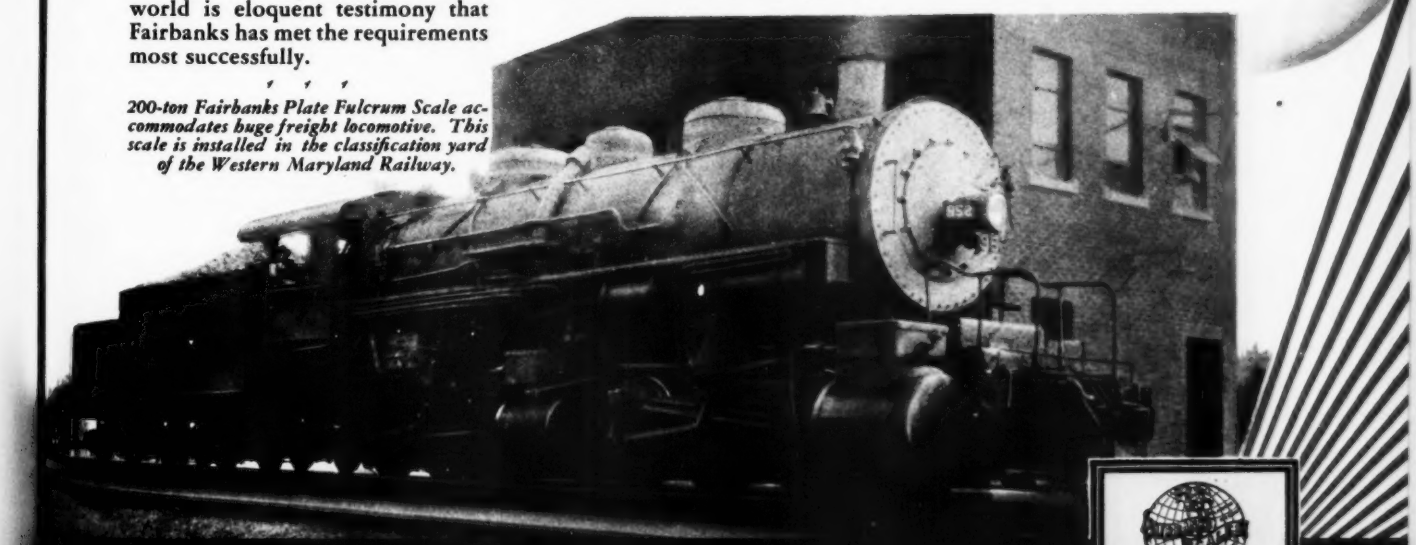
It is fitting that an outstanding Fairbanks achievement in railway scale construction should mark the conclusion of a century of scale building success. Such an achievement is the 400-ton capacity, two-section scale without dead rails which was built by Fairbanks in 1929. This modern scale—as are other Fairbanks Track Scales of lesser capacity—is built on the plate fulcrum principle first used in 1913. Neither knife-edges nor bearings are employed and the elimination of wearing parts reduces maintenance and repair expense to virtually nothing. Accuracy is assured for the life of the scale.



Interior of beam room showing beam mounting and clear vision of yards.

Fairbanks Plate Fulcrum Railway Track Scales speed up railway weighing. No dead rails are required as the heaviest locomotive can be accommodated without detrimental effect on the mechanism. Track layout is simplified and cars can be weighed *while rolling* toward the classification yard. Ample time is provided to take the weight and to record car numbers.

Interesting information about modern railway weighing methods and the economies made possible by Fairbanks Scales will be sent promptly if requested on your letterhead.



200-ton Fairbanks Plate Fulcrum Scale accommodates huge freight locomotive. This scale is installed in the classification yard of the Western Maryland Railway.

FAIRBANKS SCALES

1930 begins the SECOND CENTURY of building FAIRBANKS SCALES

1930
begins the
SECOND CENTURY
of building
FAIRBANKS SCALES

First on the rails—and *still* first

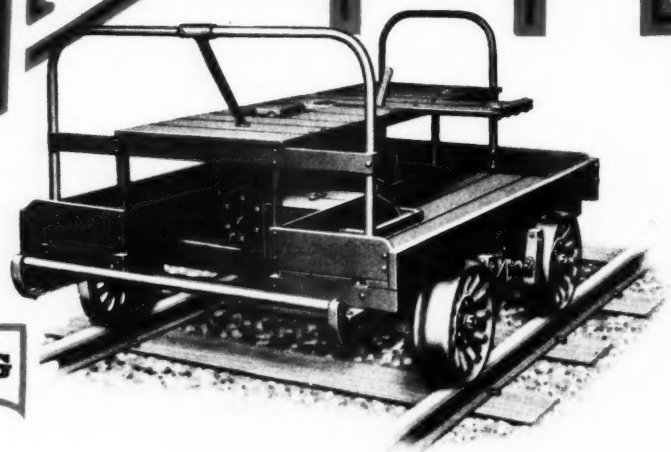
IN 1896 the first motor car propelled by an internal combustion engine appeared on American rails. *It was a "Sheffield"!* Today "Sheffield" products are used on every important railway in the United States.

For 34 years "Sheffield" has maintained leadership by building a motor car capable of giving the lowest-cost-per-mile service. "Sheffield" reliability and economical performance have been proved in actual service under every operating condition.

"Sheffield" motor cars are not the lowest *priced* cars on the market. They are built with every economy known to modern production methods. But these economies include none which impairs efficiency and dependability. If a car the equal of "Sheffield" is ever produced—the "Sheffield" will be lower priced.

Judge motor car value not on a price basis—but on an *investment* basis. Get the facts! "Sheffield" is the *lowest over-all cost* car on the market—the greatest dollar for dollar value you can buy. "Sheffield" was first on the rails—and it is *still* first!

"Sheffield 44-B"



TIMKEN BEARING EQUIPPED

FAIRBANKS, MORSE & CO., Chicago

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; stationary and marine oil engines; steam, power and centrifugal pumps; scales; motors and generators; complete coaling stations.

RSA21.2

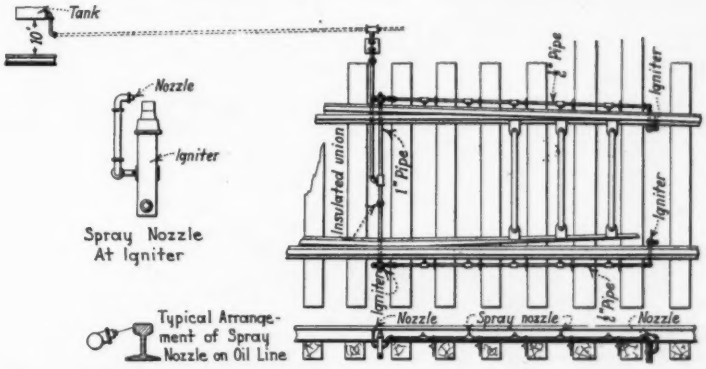
FAIRBANKS-MORSE
MOTOR CARS

MORE THAN
$1,000,000.00

have been spent on **Greer Snow Melting Installations.**

TEN YEARS of successful operation. Thousands of switches equipped.

Clears Switch in TEN to THIRTY Seconds



Easy Simple Inexpensive to Install

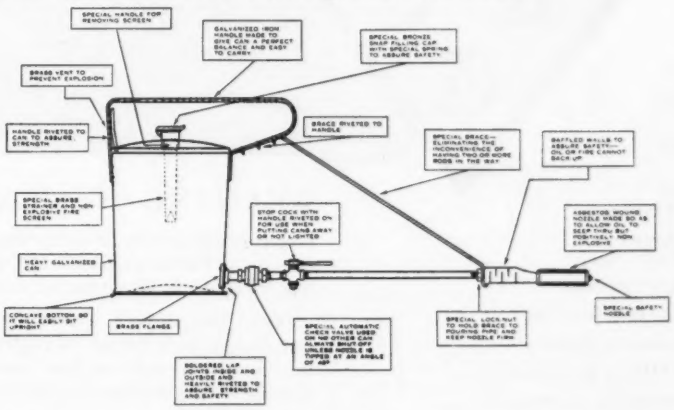
Use our Low Flash Snow Melting Oil and Greer Devices. It leaves **NO WATER** to freeze. The only permanent snow melting device with this feature.

They work in all temperatures and all kinds of weather. A great TIME and LABOR saving device. Speed Transportation, save Lives, reduce Cost of operation.

Greer Safety Snow Melting Can Improved No. 2 Type

We claim this type to be the safest Snow Melting Can ever built.

Foolproof Convenient NON-EXPLOSIVE Economical



Used by More Than THIRTY Leading Railroads

Write for descriptive circulars, blue prints, prices, etc., on Greer Devices, Greer Safety Cans, Greer Snow Melting Oils.

Our Snow Melting Oils are a result of years of experimental work and laboratory tests as well as test under actual conditions. Refined and distilled by Maloney Oil & Mfg. Co. (Forty years a leading company.)

—SOLD BY—

HOWARD P. COOK
945 Main Street,
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HODGKINS & CO.
8 So. Dearborn Street,
CHICAGO, ILL.

The screw *swivels*

as the rail *bends!*

Other Reading Specialties

ACCO One-Piece Guard Rails

"Resco" Cast Steel Guard Rail Clamps

ACCO Drop-Forged Guard Rail Clamps

Samson Rail Benders

Reversible Rail Benders

Compromise Joints

READING Replacers

Replacer Clamps

READING "Triple A" Rail Bender

Greater efficiency, less breakage and easier operation . . . these important features of the Reading "Triple A" Rail Bender should interest you.

Note the swivel *trunnion* construction. The bending screw keeps at right angles to the bent portion of the rail—it does not slide or jump along the rail—the "screw swivels as the rail bends."

Let us demonstrate the advantages of the READING "Triple A" Rail Bender.

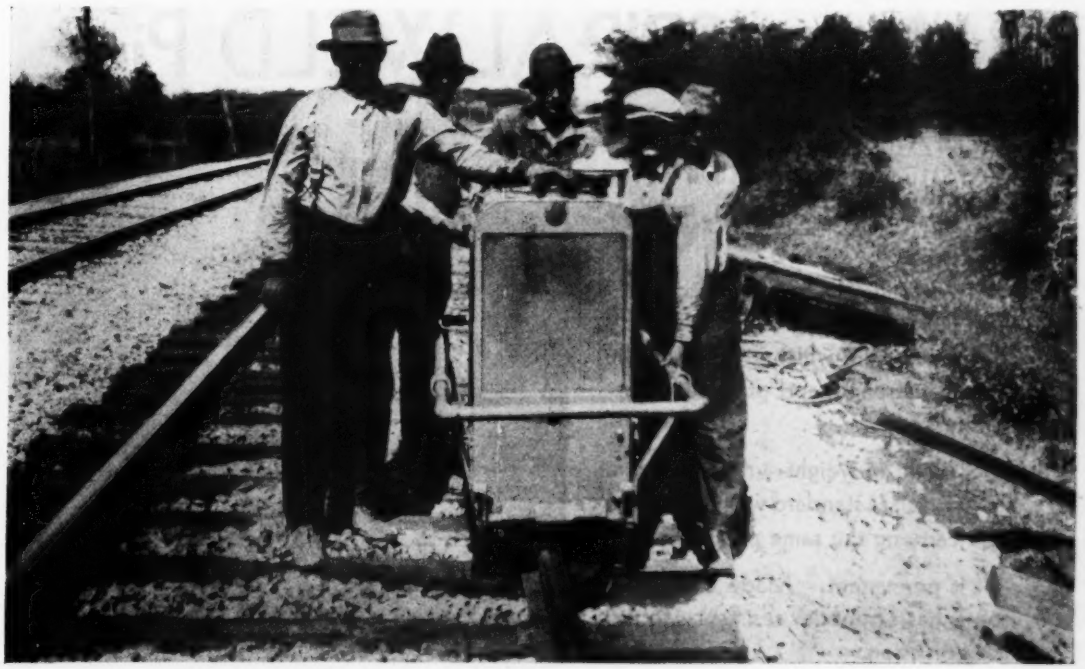
READING SPECIALTIES

AMERICAN CHAIN COMPANY, *Inc.*, BRIDGEPORT, CONN.

World's Largest Manufacturers of Welded and Weldless Chains for Every Railroad Purpose

Brake chains; Train chains; Sling chains; Switch chains; Gate chains; Wrecking chains; Crane chains; End Door chains; Door Operating chains; Brake Beam chains; Brake Beam Safety chains; etc.

ELECTRICITY IS THE MODERN POWER



MINUTES—NOT HOURS

TO MOVE A

SYNTRON ELECTRIC TIE TAMPER POWER PLANT

No jacks or skid rails necessary
No crib to build, power unit only 20" wide
No work train crane to lift it
No idle gang hours of delay

TIME SPENT TAMPING TRACK NOT MOVING EQUIPMENT

Booths 199-200-215-216 at the Coliseum

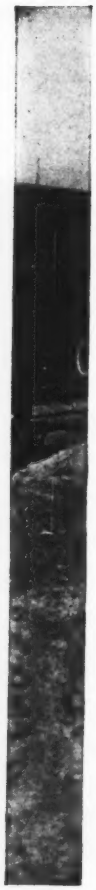
Syntron Co., Pittsburgh, Pa.

15 Factory Service Branches
Built in 4-6-8-12 Tool Outfits

Tie Tamper Power Plants Will Operate

NUT TIGHTENERS
RAIL DRILLS
SPIKE DRIVERS
RAIL SAWS
RAIL MILLERS
PORTABLE DRILLS
" SAWS
" HAMMERS
" GRINDERS
ARC WELDERS
TRACK GRINDERS
FLOOD LIGHTS

The WHY of Naylor SPIRALWELD Pipe



CERTAIN specific engineering features distinguish Naylor SPIRALWELD Pipe from ordinary pipe.

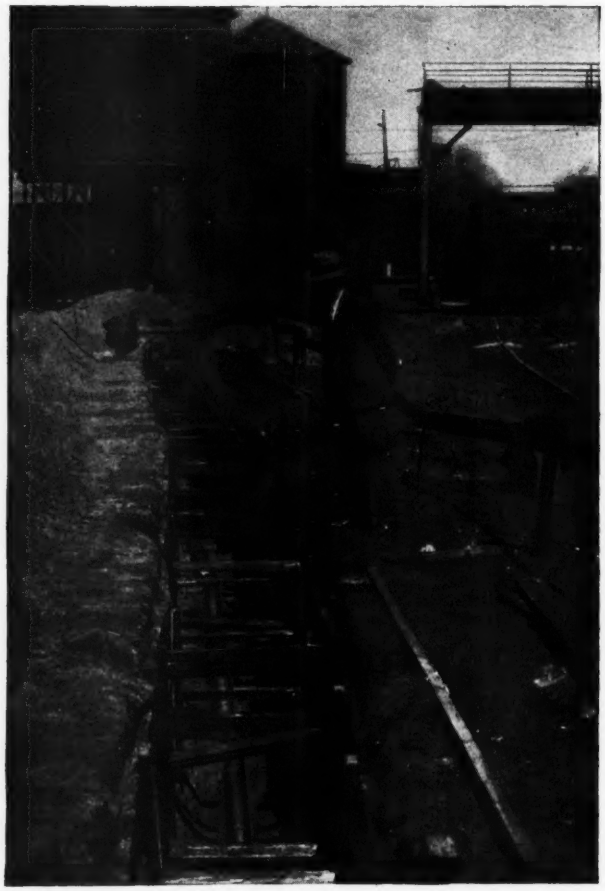
It is strong. Its spiralwelded lock-seam truss provides a mechanically correct structure which gives maximum structural strength and positive water-tightness.

It is light in weight---it weighs one half as much as standard weight wrought pipe carrying the same pressures.

It is permanent. Made of Toncan Iron it has a superior resistance to rust and corrosion.

And Naylor SPIRALWELD Pipe is furnished at no extra cost in uniform lengths of 30 and 40 feet rather than in random 18 to 22 foot lengths like ordinary pipe. This reduces pipe laying costs when used with bolted couplings.

Remember these advantages of Naylor SPIRALWELD Pipe when you are next selecting pipe for water service.



Water line of Naylor SPIRALWELD Pipe laid through cinder fill.

NAYLOR PIPE COMPANY, Main Office & Plant, 1230 E. 92nd St., CHICAGO

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25 Church St., New York

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DUCOMMUN CORPORATION
LOS ANGELES SAN FRANCISCO
Exclusive Distributors:
California, Arizona, Nevada and Utah

MONTREAL, CANADA
Mechanical Equipment Co.,
New Birks Building

TONCAN COPPER

Naylor Pipe

Maximum Structural Strength Mo-lyb-den-um With Minimum Weight

IRON

Standardized Naylor Pipe is made in sizes 6" to 12" I. D. and 14" to 20" O. D. in any uniform length desired up to 40' 0". Ends made to wrought pipe standards for all types of coupling.

Where corrosion is not a problem, Naylor Pipe can be furnished in steel.

Toncan Copper Molybdenum Iron is a development of Central Alloy Steel Corporation, the world's largest and most highly specialized alloy steel producers. It possesses a superior corrosion resistance, making it the favored pipe material.

2 men do the work of 8

"Wolf" Saws are now in use saving labor, money in cutting heavy timber. Over fifty (50) serve the railroad field alone in speeding up railwork. Representative users include—

Southern	Grand Trunk
C. M. St. P. & P.	Great Northern
Boston & Maine	Pennsylvania
C. B. & Q.	Southern
Union Pacific	New York Central
A. T. & S. F.	N. Y. N. H. & H.
C. & N. W.	Erie
Maine Central	Etc.

In confined spaces where it would be impossible to swing hand cross-cut saws the "Wolf" produces as usual. Available in A.C. 110 or 220 volts, 60 cycles, 3 phase, D.C. 115 or 230 volts. Air Driven, Ingersoll-Rand or Chicago Pneumatic Motor. Standard machines have capacity 24", however, machines of 36", 42" and 48" capacity can be supplied to order. A.C. Portable Motor Generator sets can be supplied where power lines are not available.

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WOLF Portable Timber Sawing Machine

Reduces Material-Handling and Labor Costs

Designed for speedy handling of materials, this new gasoline-operated crane will do 90 per cent of the work ordinarily done by a big locomotive crane, do it faster and more efficiently, and at a fraction of the investment and operating cost. It can be equipped with a hook, ½-yard clamshell bucket or 36-inch magnet. Write for bulletins and prices.

MODEL "MW" UTILITY CRANE

Lifts 8½ Tons
Travels 20 Miles an Hour in High Speed
Pulls 8 Loaded Cars in Low Speed
Full-Revolving
Short Tail-Swing—Will Not Foul Passing Track

ORTON CRANE & SHOVEL CO.
608 S. Dearborn St., Chicago, Ill.

Special Railway Sales Representative:
THOS. D. CROWLEY & CO.
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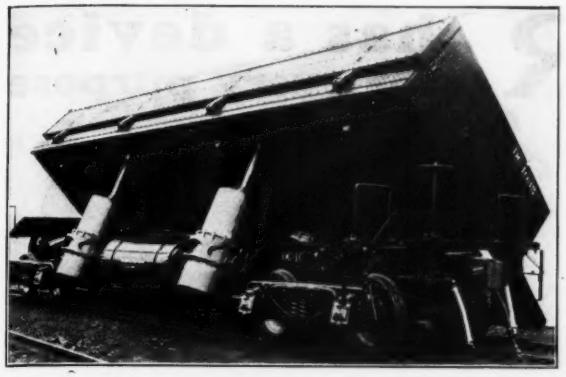
ORTON
Cranes, Shovels & Buckets



DIFFERENTIAL

Double Fulcrum AIR DUMP CARS *Double Trunnion*

In choosing your work cars it is important to select those that will give long uninterrupted service. For breakdowns cost a lot of money. The actual cost of repairing a broken down dump car may be insignificant. But the loss of the use of the car and the cost of delay to operations together with the cost of reducing the effectiveness of the auxiliary equipment may well run into a great sum. Differential cars stay on the job. A glance at the car reveals the simplicity and ruggedness that gives a long life free of ailments.

Dumps quickly but without shock. Protects tracks and trestles from destructive shock and saves car as well.

NO LOCKING MECHANISM

The body of the Differential Car rests over the bolster side bearings in its normal transport position. There is no locking mechanism. The body is just as stable as a gondola. The major part of dump car ailments disappears with the locking mechanism and the hazard of dump car operation is eliminated along with it. The Differential Car is safe, its operation is quick and sure, and there is no chance for accidental dumping.

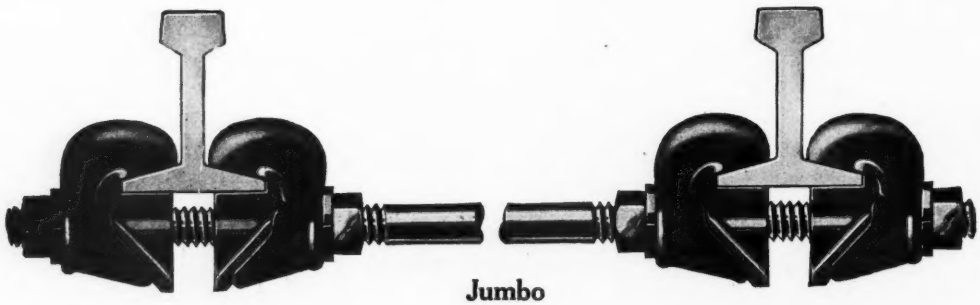
Differential 20-yard cars

Differential Cars are made in standard sizes of 20, 30, and 50 cubic yards. Other sizes can be furnished. Write for catalogue.

THE DIFFERENTIAL STEEL CAR CO.

FINDLAY, OHIO

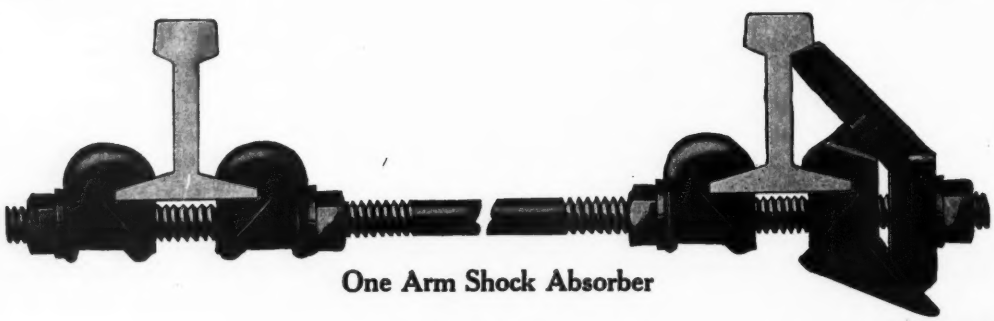
COOVER has a device for every purpose



Jumbo

Standard

Shock Absorber



One Arm Shock Absorber

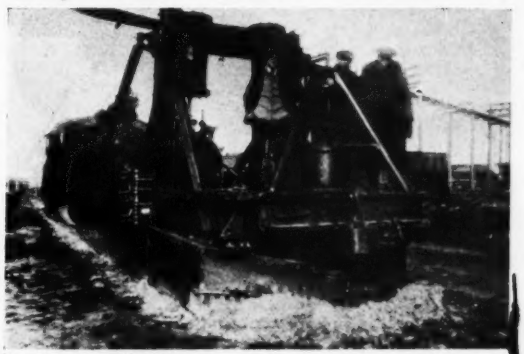
Write us
for complete Catalog

The Coover Railroad Track Brace Co.
DAYTON, OHIO

ERACO

WONDER Ice and Snow Attachment Saves TIME and MONEY

Actual Savings
In one
Canadian Railway Terminal
Average over
$40,000 Per Winter Season



THIRTY-TWO MILES or more of solid ice covered track have been cleaned out with an ERACO *in one day*. To duplicate this feat with picks and shovels would require an army of men.

The ERACO Ice Cutting Attachment consists of a steel channel frame designed to fit snugly over the plow front of a Jordan spreader. It is quickly applied—no parts of the spreader have to be removed.

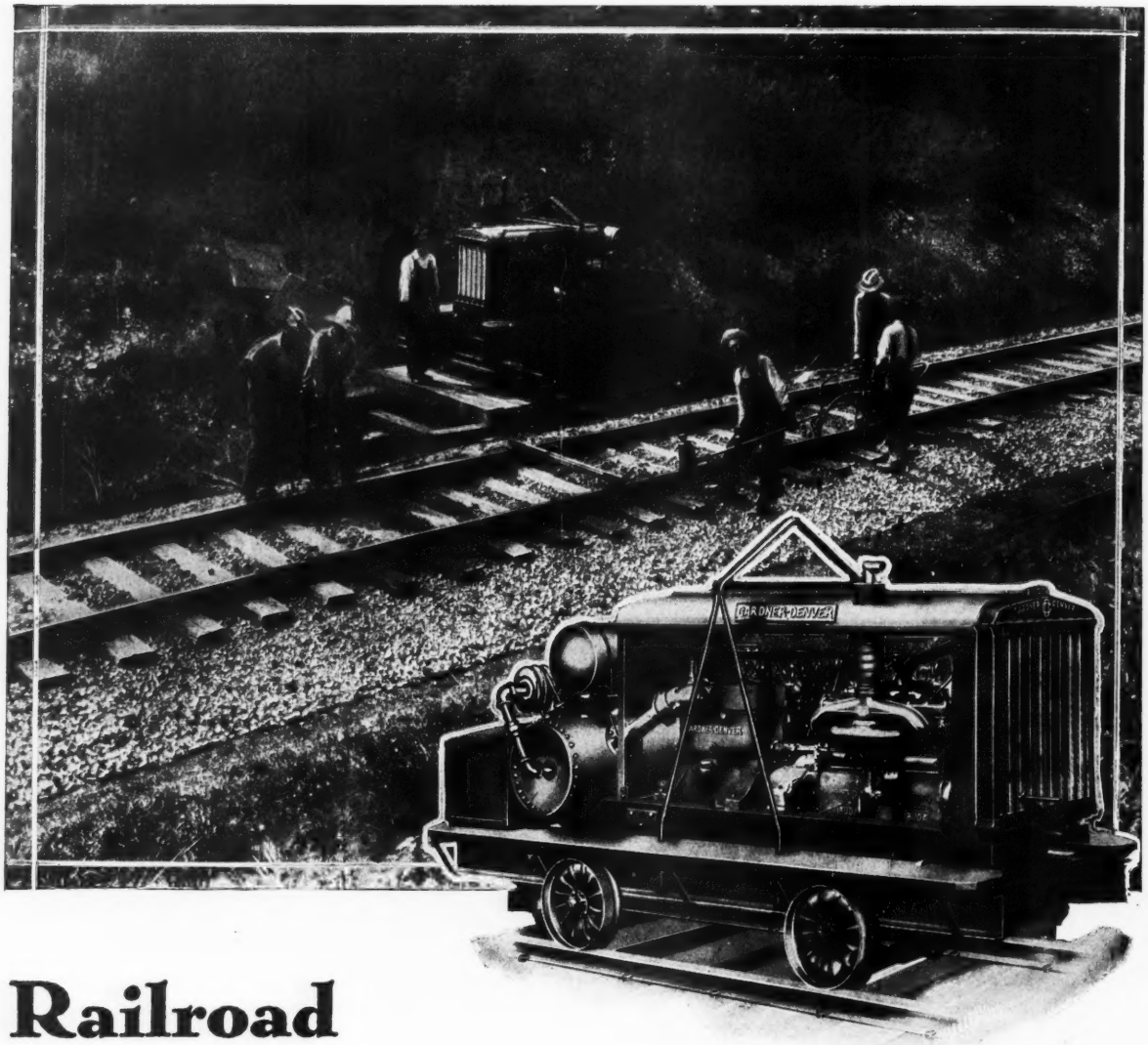
In the channel are 33 interchangeable chisels or steel teeth arranged with 7 on the outside of each rail and 19 between the two. Each chisel is fastened independently in the frame to permit adjustment for depth of cut or removal for dressing.

The ERACO Ice Cutting Attachment is simple and durable. The chisels are made of high quality steel and insure maximum service between re-grinding periods. Only one man is required at the spreader controls. The savings in one day's operation will refund the investment.

Application details and prices upon request

ECONOMY RAILWAY APPLIANCE COMPANY Limited

712-14 Railway Exchange Building Montreal, Canada

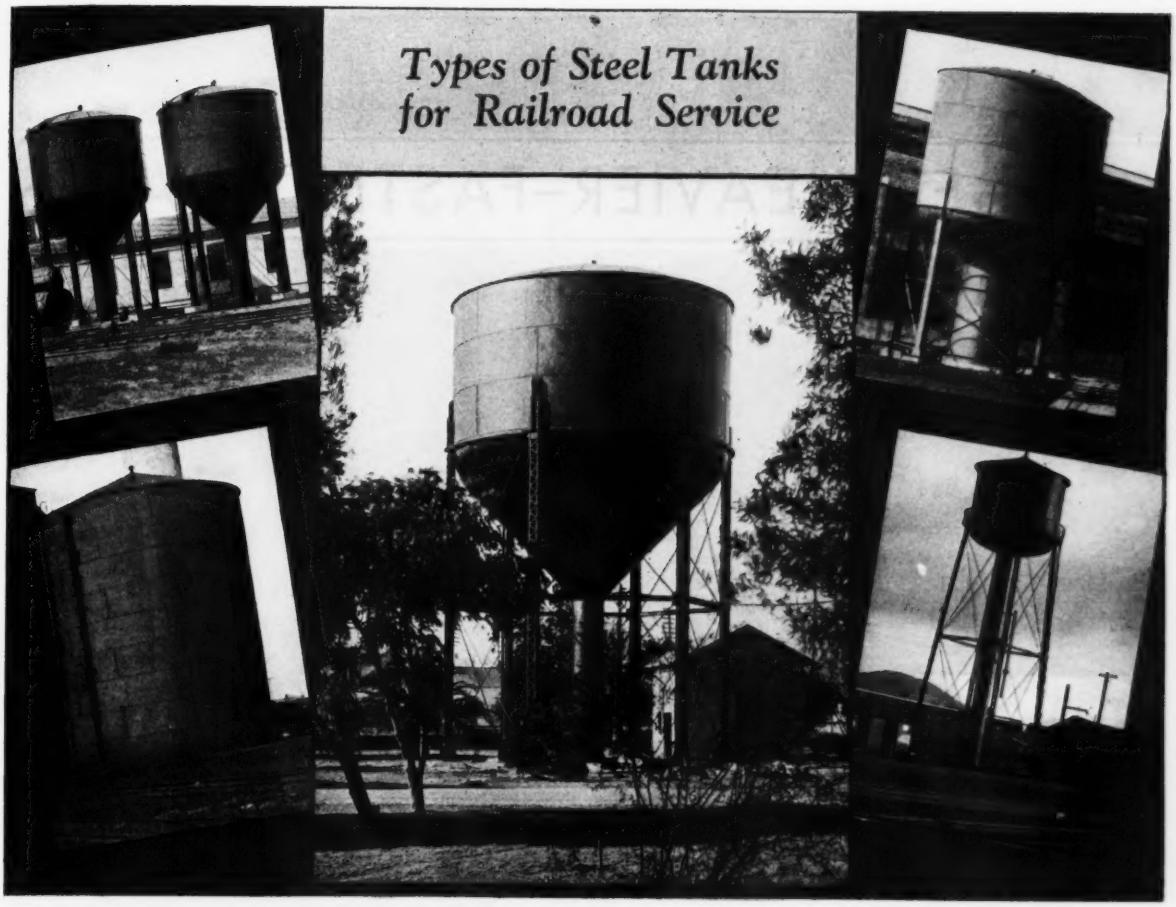


Railroad Compressors and Tie Tampers

GARDNER-DENVER Portable Tie Tamping Compressors are designed to insure efficient, dependable operation. Built in four sizes, to operate four, eight, twelve or sixteen Tie Tampers. Equipped with convenient, easily operated transverse run-off wheels and can be furnished with self-propelling mechanism if desired. Gardner-Denver Tie Tampers are sturdy tools that have proved to incorporate the proper principles and proportions for rapid and correct tamping of ballast. Let us mail you particulars regarding this exceptional equipment.

GARDNER-DENVER COMPANY
ROCK DRILL DIVISION
DENVER, COLORADO
Sales Offices Throughout the World

GARDNER-DENVER



Steel Tanks Meet Railroad Requirements

HORTON tanks, built entirely of steel, economically meet modern railroad requirements and standards. Some of the advantages are long life, low maintenance, easy cleaning, neatness of appearance and dependable operation.

Elevated steel tanks, with either conical or ellipsoidal bottoms, are standard on a great many railroads for water station service. They are also used for roadside delivery of fuel to oil burning locomotives. Regular painting is practically the only maintenance required and the tanks may be cleaned without interruption of service.

Where ground level storage is satisfactory, steel construction may also be used to advantage by installing standard flat-bottom storage tanks. Our booklet "Meeting Railroad Requirements with Horton Steel Tanks" tells how steel tanks give better service. Our nearest office will gladly furnish a copy, or quotations on steel tanks you contemplate installing.

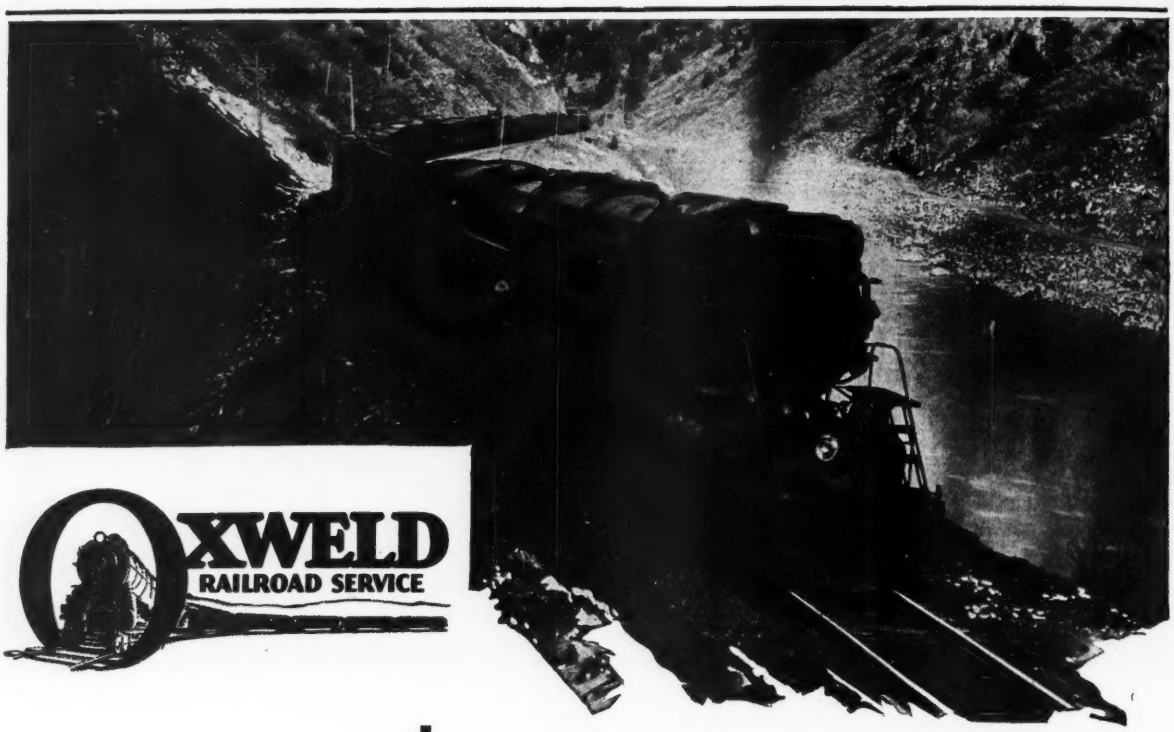
CHICAGO BRIDGE & IRON WORKS

Chicago	2452 Old Colony Bldg.	Detroit	1519 Lafayette Bldg.
New York	3156 Hudson Term. Bldg.	Philadelphia	1609 Jefferson Bldg.
Cleveland	2202 Union Trust Bldg.	Atlanta	1036 Healey Bldg.
Dallas	3309 Magnolia Bldg.	San Francisco	1007 Rialto Bldg.
Boston	1522 Consolidated Gas Bldg.	Birmingham	1546 Fiftieth St., North

HORTON TANKS

B-131

LONGER–HEAVIER–FASTER TRAINS



IMPROVED condition of track, resulting from modern methods of track maintenance, is one of the prime factors enabling the safe operation of power units of sufficient capacity to handle the longer, heavier trains necessary to take care of increasing freight business. Faster movement of heavy trains materially increases the capacity of the railway plant and is an important contribution toward the betterment of railway earnings.

The Oxweld Railroad Service Company, by supplying the oxwelding needs of a majority of the Class 1 railroads of the country is helping in the constant improvement of maintenance methods.

THE OXWELD RAILROAD SERVICE CO.
Unit of Union Carbide and Carbon Corporation
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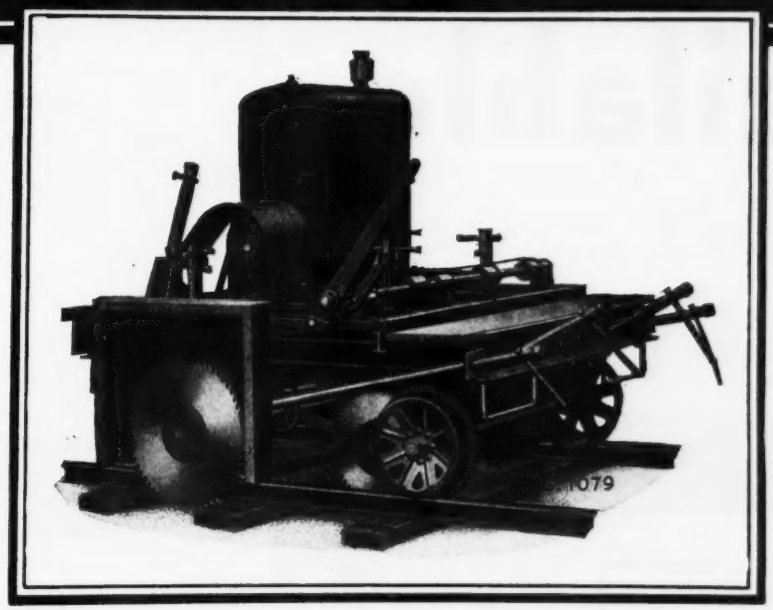


NEAFIE TIE SCORING MACHINE

THE Neafie Tie Scoring Machine has proved by performance its ability to reduce the cost of rail laying and prolong the life of ties in track by assuring a uniform bearing for the new rail.

Normally when ties are adzed by guess, the surface upon which the tie plate rests may cant either inward or outward. Usually the greatest depth of the cut is immediately under the rail, thereby throwing most of the tie bearing at the ends of the tie plate so that the plate cuts into the wood fibre and shortens the life of the tie.

The Neafie Tie Scoring Machine eliminates this tie destroying condition. It scores all ties to proper depth in four places furnishing an accurate guide for adzing and assuring a full even bearing for the tie plates in a horizontal plane or at any desired inclination.

In service, the machine is easily handled and operated. It is self-contained and built to be moved along the existing rails making a cut at right angles to the plane of the rail heads, 9 3/16" outside of each gauge line and 6 13/16" inside of each gauge line. These dimensions will be increased by the kerf of the saw in both cases. The maximum saw, 26" diameter, is used to make the outside cuts and 19½" in diameter for inside cuts. Each saw is adjustable for depth of cut by sixteenths of an inch and is locked at each setting. All saws are raised to traveling position by one hand wheel, a ratchet and wheel holding them in place.

When the car is traveling along the right of way both saws will clear the top of the rail by 2 inches. The saws are guarded to protect workmen against injury.

The Only Bender available

THAT HANDLES 130 lb. rails WITH ONE MAN

The BUDA Jack Type Rail Bender is far superior to any bender ever produced for heavy T rail. It does not bind like ordinary screw type jack benders. It saves you time and money and quickly pays for itself—as stock rail bends and guard rail bends can be made in the field. The BUDA is light weight, compact, easy to handle.

Write today for bulletin No. 683.

THE BUDA COMPANY

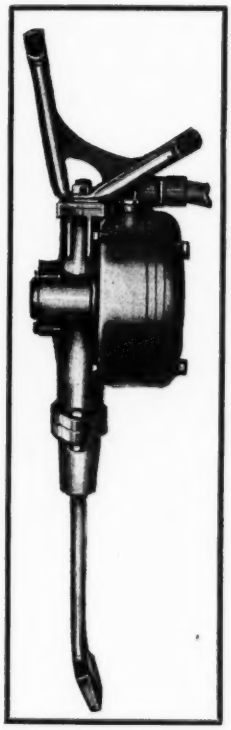
HARVEY (Chicago Suburb) ILLINOIS

30 Church Street NEW YORK
Railway Exchange CHICAGO
Railway Exchange ST. LOUIS
664 Mission Street SAN FRANCISCO
Harvey Works WEMBLEY, MDX, ENGLAND

PIONEERS IN THE MANUFACTURE OF ELECTRIC TIE TAMPERS

And now—

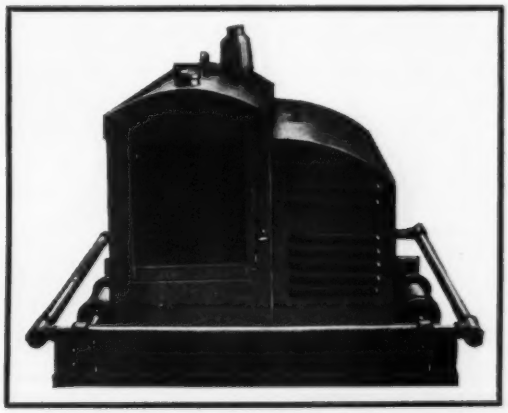
The Jackson Electric "HAMMER BLOW" Tie Tamper



1800 Heavy Direct Blows Per Minute to the Ballast

A fast, simple and efficient tie tamper, easy and economical to operate. A companion to the Jackson "Universal" Tie Tamper. By equipping your maintenance gangs with both types of tampers (the same power unit operates either) they can do better work at substantial savings under all conditions and in any kind of ballast.

We invite your inspection of our complete line of Electric Tamping Equipment at the N. R. A. A. Exhibit to be held in the Coliseum, Chicago, March 10 to 13.



The same power units used with the "Universal" Tamper are used to operate the Hammer Blow Tamper.

ELECTRIC TAMPER & EQUIPMENT CO.

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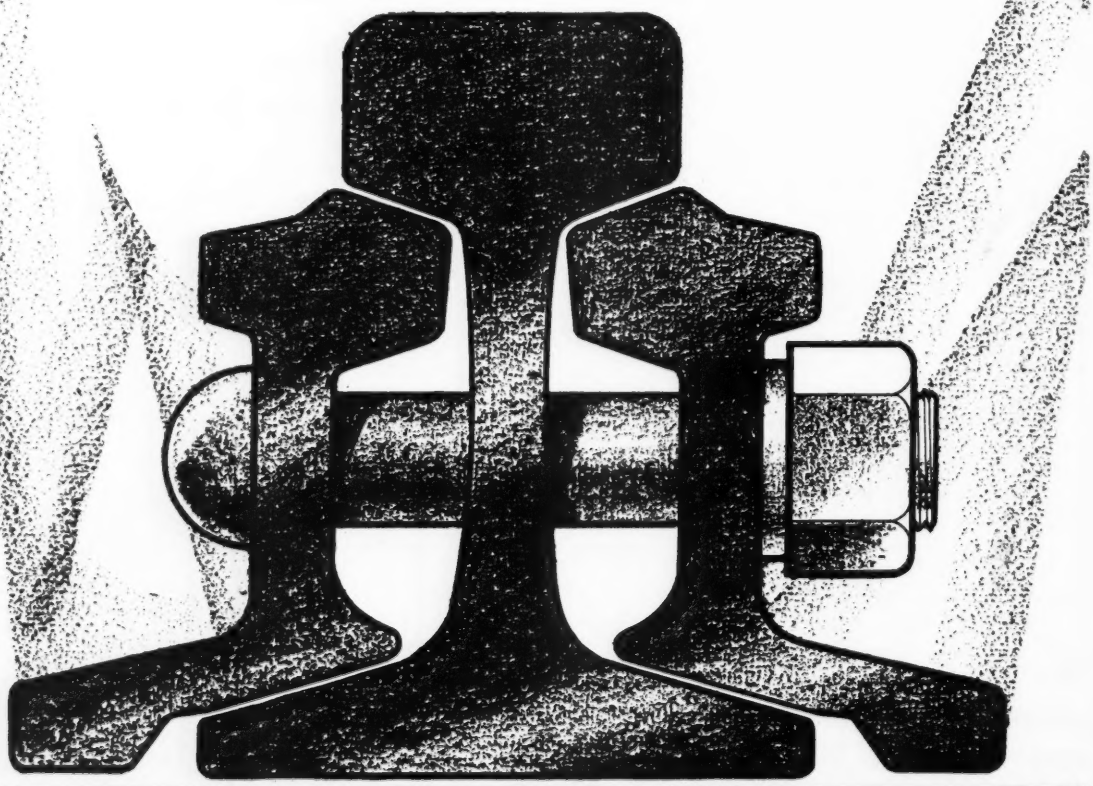
STEEL SERVICE

CONTROL of manufacture from the mining of the ore until the finished product is ready for shipment, combined with extensive and modern manufacturing facilities, enable us to promptly and efficiently supply your steel requirements. Carnegie products of special interest to railroads include Standard Rails and Heat Treated Splice Bars, Structural Shapes, Bar Mill Products, Wrought Steel Wheels, Forged Steel Axles and Steel Sheet Piling. Let us quote on your next requirements.



CARNEGIE
RAILS *and* SPLICES

Products of CARNEGIE STEEL COMPANY, Pittsburgh, Pa.—*Subsidiary of United States Steel Corporation*

37

THE SOUND THAT COUNTS—

"THE CLANG OF SHOVELS"

Big business men were told at a Washington Conference that "the only sounds that really count are the clang of shovels and cash register bells" . . . But some shovels count more than others. The Bucyrus-Erie 2030 Shovel-Crane-Dragline is noted for outstanding performance in railway maintenance work . . . Specially built for this service it is fast in operation, easily maneuvered, and easily converted for the class of work required . . . Here is the machine for top-notch efficiency — whether digging ditches along the road bed, shouldering the banks of deep cuts, or handling ballast from its position in a work car . . . One railroad alone purchased 33 of these machines during the past year. Investigate the 2030. Write us today.

A-41-3-30-REM

Power shovels, clamshells, cranes, draglines, dragshovels—½ to 16-yard capacity — electric, steam, gasoline, Diesel, gas + air, Diesel + air.

Dipper, hydraulic and placer mining dredges.

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Plants: South Milwaukee, Wis., Erie, Pa., Evansville, Ind.—General Offices: South Milwaukee, Wis.—Branch Offices: Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Dallas, San Francisco.—Offices or distributors in all principal countries. Representatives throughout the U. S. A.

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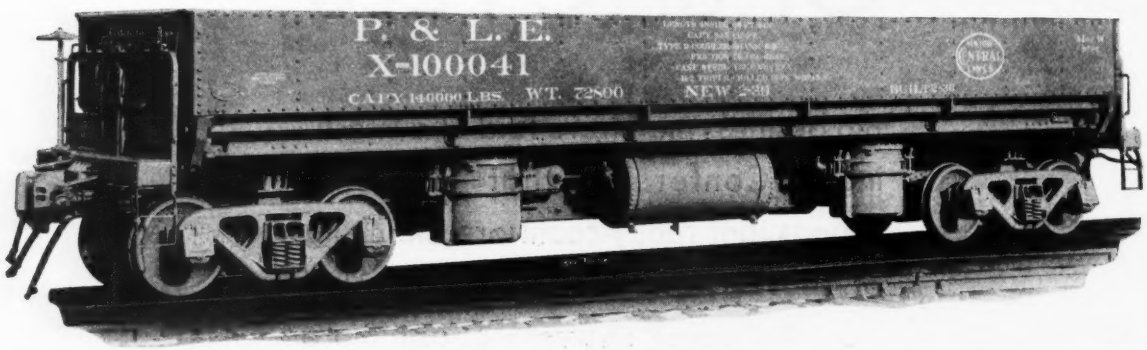
A COMMANDING ACHIEVEMENT



35 cu. yds.—70 ton capacity
Built for P. & L. E. R. R.

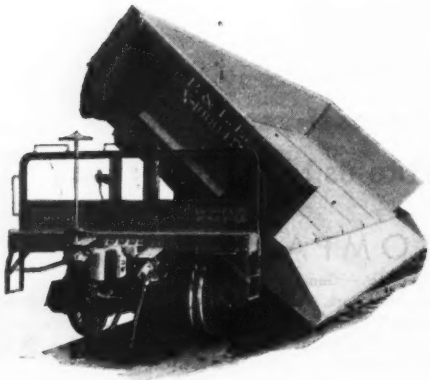
THE KOPPEL AIR DUMP CAR

Rolling Trunnion Type

Koppel's long experience in building and designing many of industry's most successful cars is concentrated into the design and construction of this strong, rugged, all-steel air dump car.

A quick, clean, dumping action is assured by the unique design of the doors which automatically turn out and down as the car body is elevated into the dumping position.

Time Saving
Labor Saving
KOPPEL
Safe and Serviceable



See our exhibit at the Coliseum March 10th-13th—Booth No. 285

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NEW YORK CHICAGO **KOPPEL, PA.** SAN FRANCISCO PITTSBURGH

Pounding....Driving....Tearing....

EVEN WHILE YOU ATTEND THE CONVENTION

Every day, unseen but not unheard —they pound and rip, strain and wrench at the very foundation of your road—your trackage! WEAR AND TEAR—the profit eaters—the service destroyers —are costing railroads MORE THAN even RUST and DECAY.

SEE YOU AT THE AREA CONVENTION BOOTH 171½ TO 172½ MAR. 10-13

Halt them in their costly path—track reconditioning by Morrison maintains service — reduces maintenance cost to a fraction. A letter to our nearest office—or a word at our display booth (171½-172½) at the N. R. A. A. Exhibit will give you full details.

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INDIANAPOLIS—MARYSVILLE, PA.

"DEVOTED TO ECONOMIES MORRISON RAILWAY SUPPLY CORP. IN TRACK MAINTENANCE"

VERONA RATCHET ACTION TRACK WRENCH

(PATENT PENDING)

IMPROVED: CAN BE USED ON WORN OR ROUNDED CORNER NUTS AS WELL AS NEW NUTS

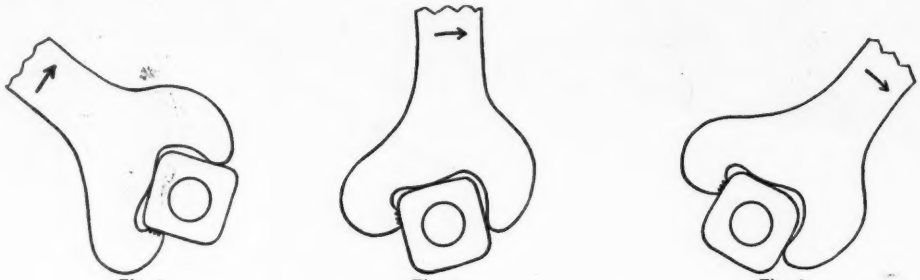


Fig. 1 Fig. 2 Fig. 3

Showing One-Quarter Turn of Nut

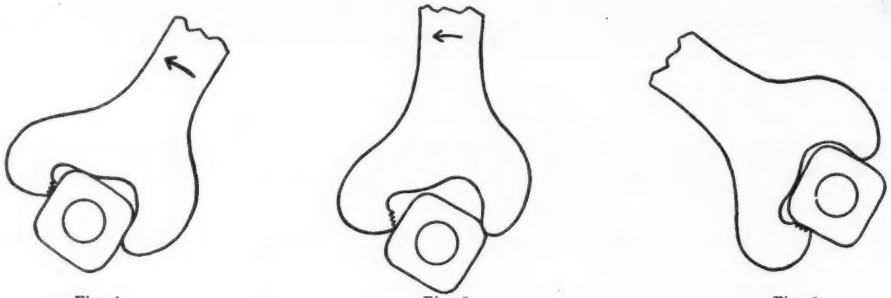


Fig. 4 Fig. 5 Fig. 6

Showing Ratchet Action of Wrench

THE VERONA **IMPROVED** WRENCH can be used in *section gangs* where nuts are rounded as well as in extra gangs where they have always been used. The wrench is lighter than the ordinary track wrench, yet stronger, making it desirable for track walkers.

The Ratchet Action makes it unnecessary to remove wrench from the nut to take a new grip or hold after each quarter turn. Backward or releasing push (Fig. 4) is only necessary. This releases jaws from nut (Fig. 5) and permits the wrench to move over the face of nut until it takes a new grip. (Fig. 6)

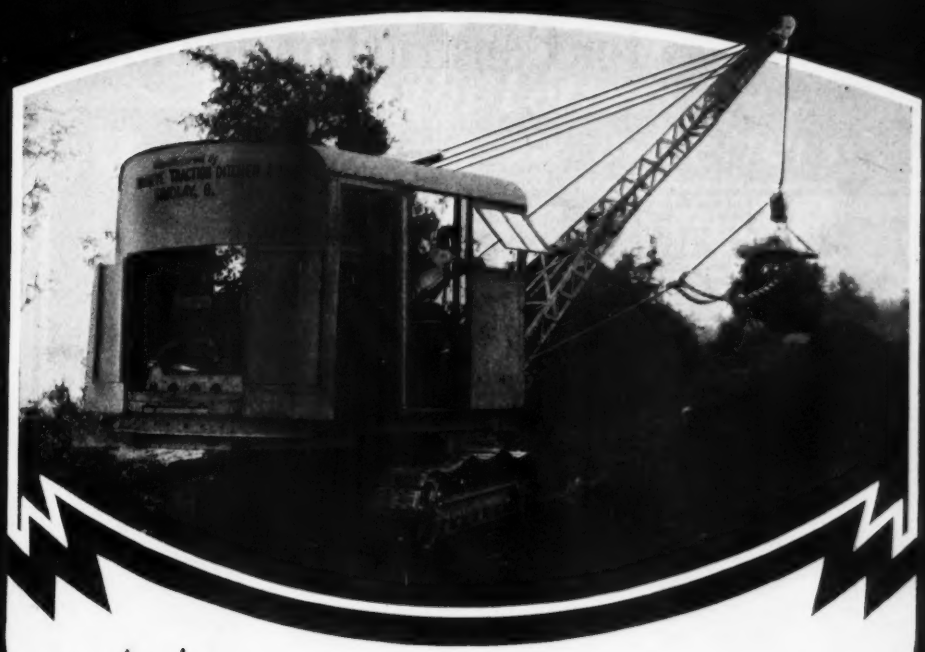
EASY TO OPERATE—RAPID IN ACTION—HIGHEST GRADE STEEL—DROP FORGED

Its labor saving in first day's operation will be greater than its cost

MADE FOR ALL SIZES SQUARE NUTS

SEE IT AT BOOTH 41—N. R. A. A. EXHIBITS—COLISEUM

VERONA TOOL WORKS - PITTSBURGH, PA.



Master of Its Field

Within the range of its capacity, this Buckeye Utility Crane (¾ yard) is the master of its field. It is quickly convertible—without drum lagging—from Clamshell to Dragline, Orange-peel, Backfiller or Crane service. This wide range of working ability extends its usefulness and multiplies its earning power. In fact, the profitable applications of this efficient little Crane are limited only by the ingenuity of the man in charge of the job in adapting his methods to it.

The utility of this popular Buckeye is further increased by its availability in either of two mountings—*Flanged* wheels for operation from main track or rails laid on flat cars, and *Alligator (Crawler) Traction* for service independent of rails.

Write for specifications and construction details

THE BUCKEYE TRACTION DITCHER CO.
FINDLAY, OHIO

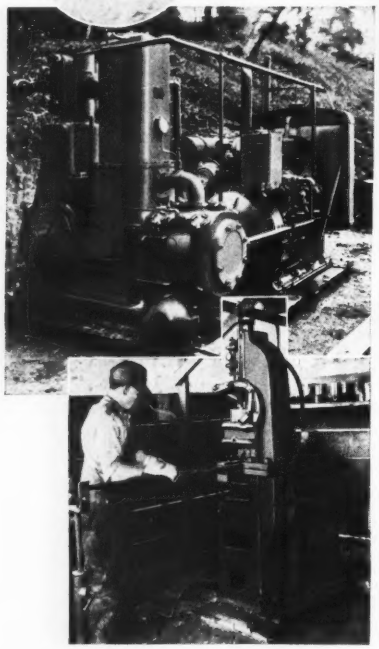
There's a Buckeye Sales and Service Office near You

for over thirty years

Buckeye

Sullivan Air Power Service is 3-Fold, for Construction and Maintenance

Left: Sullivan Rotator breaking a big one for the shovel on the Castlewood project. Below: The Sullivan Balanced Angle Diesel driven Compressor (Tex-Rope drive), and the Sullivan Drill Sharpener, which back the drills on the cut.



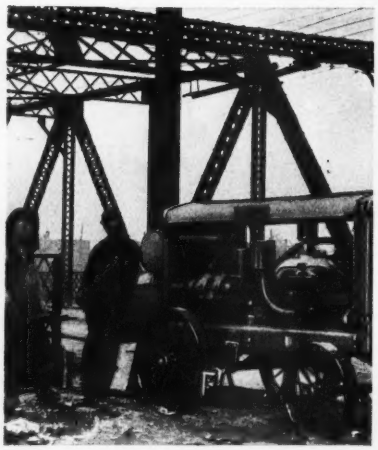
Rock Excavation

The pictures above were taken at Winston Hill Missouri, on the Castlewood project—where Winston Brothers are making a new cut for the Missouri Pacific.

A Balanced Angle Compressor was selected to run the drills. For its smooth operation makes possible the use of skid mounting; and its adaptability to any drive will enable the contractor to use the cheapest power available, on subsequent contracts. **Booklet 83-L.**

New Sullivan "L-6" 58-lb. Rotators were picked from a wide line of Sullivan down-hole drills, to speed the drilling. **Booklet 87-C.**

Steel is kept ready with a Sullivan All-Hammer Sharpener. **Booklet 72-J.**



Sullivan Vibrationless Portable Compressors, supply air to sandblast and spray paint a bridge.

Track, Bridge, and Yard

Sandblasting and spray painting of bridges, tie-tamping, and other tasks now done more profitably with compressed air, have a real asset in the extra dependable Vibrationless Compressor.

Seven models, gasoline and electric, from 103 to 310 feet, are available for your selection. Steel Wheels, "tie-tamper" truck, or skids. **Booklet 83-F.**

Sullivan Rock Drills, Concrete Breakers, Clay Spaders—and Sullivan Portable Hoists for rail laying and other construction, are illustrated below. **"Speed Up With Air"** will tell you more about them.

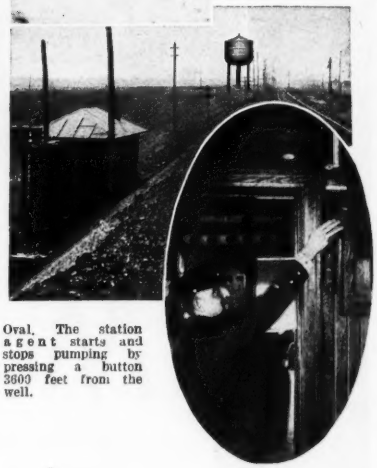
Sullivan 39-lb. Rotator

Sullivan Spader

Sullivan Concrete Breaker

Hoist

Below: Sullivan Air Lift near Telford, Pa. Picture shows compressor and booster station in foreground, with tank 535 feet distant.



Oval. The station agent starts and stops pumping by pressing a button 3600 feet from the well.

Trouble-free, Automatic Water Supply

Sullivan Air Lift wells have no moving parts under water to require inspection or repair; there is no pulling of sucker rods or working barrels; and no trouble is experienced with sand, mud, crooked wells of varying water levels. A number of pumps may be controlled from one power plant, and fewer pumpers are needed.

Air Lift Air Made wells develop dependable water supply where sand prevents all other systems from maintaining the g.p.m.

Sullivan Air Lift is available, entirely automatic, or with push button control.

Send for Catalogs 71-I, and 56-J.

SULLIVAN AIR POWER EQUIPMENT

Sullivan Machinery Company

708 Wrigley Bldg., Chicago

REORDERS

These Eight Letters Are Genuine Testimonial Letters

—a trial order for two **Nordberg Power Jacks** in February, 1929; then orders for fourteen more machines within the year.

—a trial order for two **Nordberg Adzing Machines** in March, 1929; then orders for fourteen more machines within the year.

This is the record of orders for Nordberg Labor Saving Track Machines on **one** large trunk line railway.

The reasons why this railway and many others "Repeat on Nordberg Labor Saving Track Machines"

SPEED

—that runs away from tamping gangs and enables **one** man to raise a mile or more of track a day.

—that is coupled with a lift which doesn't throw track out of alignment.

—that reduces the time the track is closed to traffic.

SPEED

—that enables one man to adz from 300 to 600 ties in one hour.

—that is coupled with a degree of accuracy never possible with hand adzing. Every tie is adzed exactly the same.

—that cuts "slow orders" to a fraction.

It will pay you to investigate

NORDBERG MFG. COMPANY

MILWAUKEE, WIS.

Will Your Culverts Withstand Vibration?

THE vibrations and shocks of railroad service have a widespread effect on drains. The rumble of a train is felt a long way off. That vibration shakes the drain every time a train passes.

If the drain is flexible no harm is done; if not there is soon another job for the maintenance gang.

Toncan Iron drains are flexible to withstand vibration and are unaffected by pounding wheels, freezing or the pressures from the shifting soil.

They also last longer. Corrosion was once the corrugated culvert's worst enemy but now that has been checked by using Toncan Iron.

To iron that has been thoroughly refined are added copper and molybdenum. These two elements alloy with the iron and impart a corrosion resistance that has never been reached before by culvert metal.

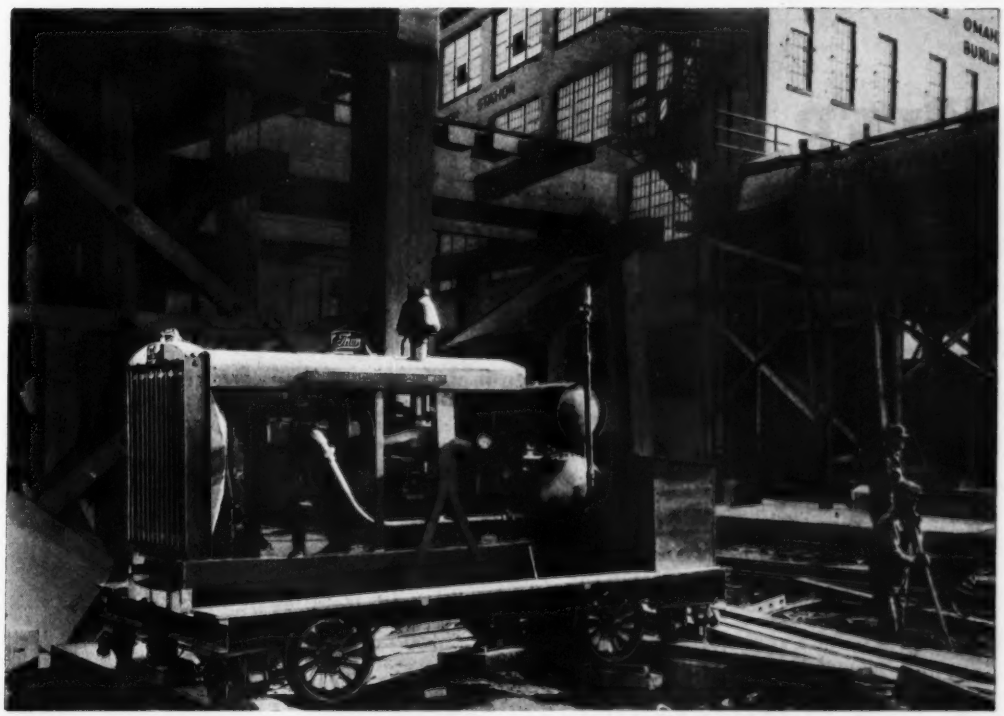
Thus Toncan Iron is particularly fitted for the permanence which is so necessary in culverts. Yet Toncan costs no more.

TONCAN CULVERT MANUFACTURERS' ASSOCIATION
MASSILLON, OHIO

Plants Located in All Parts of United States and Canada

TONCAN COPPER MO-LYB-DEN-UM IRON

What the *SUPER CHARGER* of the *Thor* SIX AIR COMPRESSOR *Meant on this RAILWAY BRIDGE JOB*



A big railroad company had to re-construct several of their bridges and overhead viaducts. Time was an important factor. Traffic could not be held-up. For these reasons, Thor Air Compressors were selected because the patented Super-Charger meant more air delivery, which speeded up the job and eliminated the necessity of using larger, heavier and more expensive compressors.

The Super-Charger of the Thor Six Air Compressor is not just "sales talk." It means more air for your money. It means that you can buy the Thor Compressor rated at 250 cu. ft. instead of the usual 310 cu. ft. machine and operate just as many tools; or you can buy the Thor Compressor rated at 116 cu. ft. instead of a 160 cu. ft. size and accomplish the same results.

The Rix Super-Charger is an exclusive, patented feature of the Thor that enables the piston on its idle or downward stroke to compress the additional air the Thor delivers. And the Super-Charger adds no complications. It is simple, fool-proof and efficient.

The Thor is direct-driven—both engine and compressor being mounted on one crank case, eliminating gears, clutches and couplings. A deep section type cast steel frame carries the mounting of the unit which makes a rigid foundation, minimizing vibration and distortion.

Thor Compressors are made in two sizes—116 cu. ft. and 250 cu. ft. Both sizes are 83% efficient. They can be furnished on either self-propelled or non-self-propelled rail cars.

On the basis of "more air for your money," the Thor deserves an investigation. Complete information is yours for the asking.

Thor Pneumatic Tie Tampers, Spike Drivers, Spike Pullers, Rail Drills and Track Bolt Wrench are the products of an engineering staff of 37 years experience in designing Pneumatic Tools. Give them a trial.

SEE OUR EXHIBIT AT THE NATIONAL RAILWAY APPLIANCES ASSOCIATION—BOOTHS 220-221.

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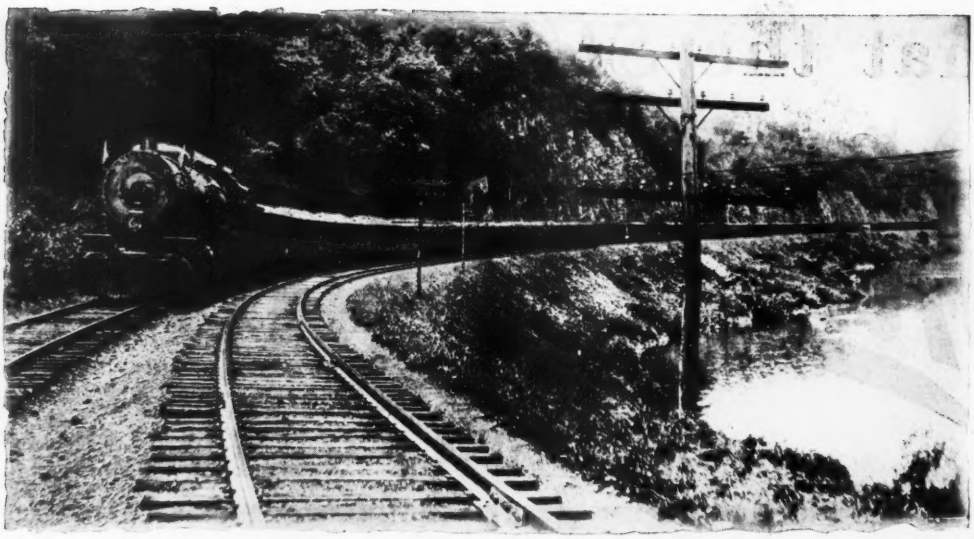
PNEUMATIC TOOLS ··· ELECTRIC *Thor* TOOLS ··· AIR COMPRESSORS

276 South Jefferson St. Chicago, Illinois



KEEP DOWN the UP-KEEP
OF TRACK ON WINDING RIVER DIVISIONS WITH MEXICAN GRAPHITE CURVE GREASE

WINDING River Divisions with frequent curves and grades require efficient lubrication on the rails. Otherwise the life of curves would be comparatively short and the up-keep exceptionally high.

When a locomotive rounds a curve the flanges crowd and tend to climb the rail. It is right at this critical point that Mexican Graphite Curve Grease furnishes effective lubrication thereby reducing the frictional wear and tear on rails and minimizing the curve drag and train resistance.

This grease is a distinct economy when its negligible cost is compared to the big savings in rails and maintenance.

Mexican Graphite Curve Grease sticks and stays on the rails and tires regardless of rain, sleet or snow and affords protection against friction long after ordinary grease has outlived its usefulness.

A trial will convince you

The United States Graphite Co.
Saginaw, Mich.

Philadelphia New York Chicago Pittsburgh St. Louis

Mexican Graphite Curve Grease USG

SAVES RAILS – REDUCES FLANGE WEAR

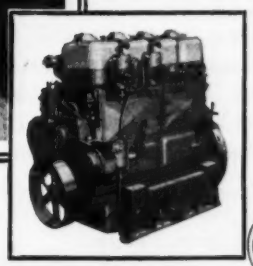
ABOUT sixteen years ago, gasoline-powered excavators were introduced. They proved so efficient that they have now practically replaced the steam shovel.

But progress was not content. So, some six years ago, Diesel power was first applied to excavating machines. These engines have proven themselves so dependable and so economical . . . so generally superior as a power source for excavators . . . that what was, at first, a ripple of approval is now a tide of unmistakable preference.

A Diesel-powered P & H not only saves from 75 to 85% on fuel cost, but actually turns out 10 to 15% more yardage than a gas machine. This is due to Diesel power's steam-like torque characteristic. The slower a Diesel engine goes in hard digging, the harder it pulls.

To get the lower dirt-moving costs so necessary today, men with excavating to do now favor the Diesel. They naturally turn to P & H who have played such an important part in the development and perfection of the Diesel-powered excavator.

If you want more information on this modern form of excavating, write the



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GAS DIESEL ELECTRIC
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ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: WHY A LABOR SAVING ISSUE?

Dear Reader: February 25, 1930.
Everywhere

One of the problems which we keep before us in selecting material for publication in Railway Engineering and Maintenance each month is to provide a maximum diversification in subject matter. We do this in order that we may cover all of the varied branches of roadway and structures work in which you are engaged. Yet we are devoting this issue exclusively to the single problem of the application of improved machinery and materials to maintenance of way operations. Why do we so "unbalance" this issue?

Even though you may not have actually asked this question, it is an obvious one and deserves an answer. In the first place whether we like it or not, we are living in a "machine age" and if we and the railways from which we derive our livelihood are to continue to progress and prosper we cannot do other than keep pace with this trend.

But there is a more direct personal reason than this. None of us would now be willing to go back to the conditions under which we worked 15 years ago. The increased output resulting from the use of machinery has made it possible to reduce our hours of labor from a standard day of 10 hours (frequently 11 or 12 in the summer) to 8. Even more important, machinery has lightened many back-breaking tasks. Who of us who are now provided with motor cars is willing to go back to the hand car? Who of us who have become accustomed to the handling of rail with cranes in relaying operations desires to return to tongs? What track man who has been provided with mechanical tampers wants to return to the old methods? We are in a new day in maintenance of way work - one in which we can do more work in a shorter time and with less effort than ever before.

It is for these reasons that, starting in 1918, we have devoted an entire issue each spring to the consideration of labor-saving problems, and we concentrate in its pages, - editorial and advertising, - the latest information regarding the mechanical aids that are available for the progressive maintenance man. We have been told that by focusing the attention of maintenance of way men so directly on this development we have done much to further its progress. We hope that this is so. We hope that you may find much in this issue that will be of interest and help to you in removing the drudgery from your work and at the same time in making your operations more efficient from the standpoint of your railway.

Yours very truly,

ETH*MM

Elmer T. Howson

Editor.

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This Straight Edge Tells the Story!

KNOW the true facts concerning the actual condition of your rail ends! Learn how every length of rail can be made to give many extra, added years of service without removal. Know these facts about rail maintenance without cost or obligation. The TELEWELD PROCESS engineer will tell you, after he has completed a survey of your steel, ABSOLUTELY FREE!

The TELEWELD PROCESS engineer will tell you why 21 class A railroads have used TELEWELD PROCESS for rebuilding rail ends, electrically, a mile at a time, and why it is the most economical, efficient service of its kind!

TELEWELD PROCESS takes your rail end at normal welding temperature; preheating is eliminated. The heat is concentrated directly upon the point of work, securing the maximum penetration depth and insuring perfect fusion of old and new metal. There is no radiation of heat into the rail back of the weld. The finished weld is surface and cross-ground to a smooth, accurate finish. Actually, the rebuilt end is better and stronger than new!

And a big feature of the TELEWELD PROCESS lies in the fact that responsibility is always directly fixed. Craftsmen, who are specialists knowing the full effect of heat on metals, are employed to render this service. Get the complete facts NOW. Send for the TELEWELD PROCESS engineer.

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New York + Cleveland + Salt Lake City + Boise + Spokane + San Francisco

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Saves Labor

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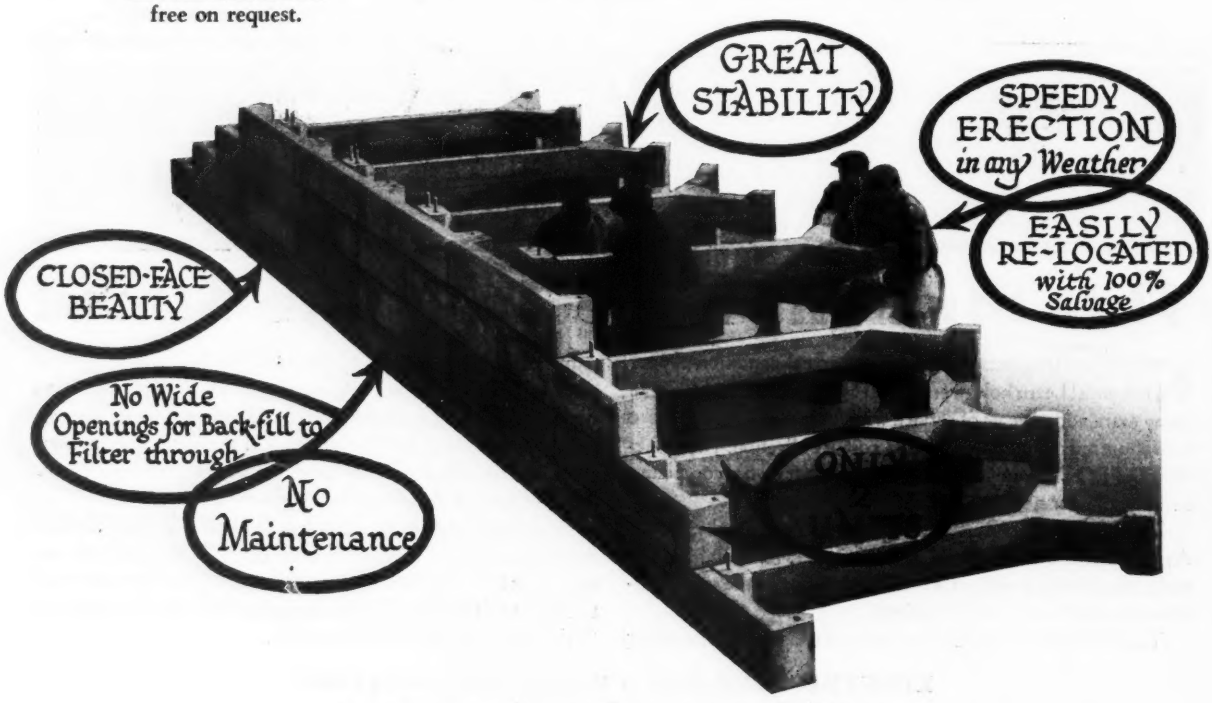
—no maintenance whatever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When Speed Is Essential, Safety Must Be Automatic

Behind Racor Service stand nine plants specialising in the manufacture and distribution of railroad track turnout and crossing equipment, including Manganese Work for heavy traffic.

THE good old days, when switching was simple and leisurely, gave men plenty of time to think about safety—and even then they made mistakes.

Today, in the modern classification yard, too much speed is demanded of men to expect them to be over-cautious. Safety must be provided by automatic safety devices.

Ramapo Safety Switch Stands permit cars to be trailed through closed switches without damage to switch points, switch stand, track or car. Literally nothing unusual happens, except that the target follows the switch points to indicate their true position. The switch is always ready for manual operation.

So successfully do they operate, so completely do they eliminate accidents and maintenance, so effectively do they speed up the work that over 300,000 of them are in use on leading American railroads.

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Railway Engineering and Maintenance

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Omission of Motor Car Article

BECAUSE of the large amount of material pressing for publication in this issue relative to new and improved equipment for maintenance of way work and to its application to these tasks, it has been necessary to hold out the third article in the series on the Operation and Maintenance of Motor Cars. This article, on the design of the motor-car engine, will appear in the April issue and others in the series will follow in regular order in the succeeding issues.

A Machine Age

THIS IS a machine age. Its influence is striking deep into every industry. It is bringing fundamental and far-reaching changes in our economic life, the full effect of which cannot yet be foreseen. It is a response to the universal demand for greater efficiency in production, supplemented by the desire of labor for the elimination of drudgery.

In no industry is the substitution of mechanical for manual means taking place more rapidly than among the railways, and nowhere in the railway industry is this transition proceeding faster than in construction and maintenance of way operations. It is difficult to appreciate the progress that is being made, unless one establishes a comparison with conditions existing at some prior period. In the field of labor-saving equipment, this contrast can be made with periods as recent as 10 or 15 years ago.

Consider the annual labor-saving issue of *Railway Engineering and Maintenance* as an illustration. Started only 12 years ago, the interest in this subject was then so limited among railway men and manufacturers alike that the proposal to devote an entire issue to this subject was abandoned after two years' trial and was not again undertaken until 1923. Since that time interest in the labor-saving problem has grown so rapidly that the March issue is now the outstanding issue of the year.

As pointed out by R. H. Ford in an article on page 94, the introduction of labor-saving equipment in maintenance of way work is affecting the conduct of this work to its very heart. Not only is it forcing the re-organization of gangs for such specific tasks as the relaying of rail and the ballasting of tracks, but it is causing many maintenance officers to consider whether the time-honored form of section and extra-gang organization should not be changed. The demonstrated economy of mechanical equipment for a wide variety of tasks makes its universal use for these tasks desirable, if not imperative. On the other hand, the multiplicity of gangs makes such an expenditure prohibitive. Confronted with this dilemma one road, the Great Northern, has carried out a rather marked change in organization, while another, the Milwaukee, introduced a new plan of organization last year, as described on page 119, to meet this problem. Other roads are approaching it from different angles.

As we progress further in the development and use of labor-saving equipment we are also learning more of its requirements. Thus, we are now coming to recognize that it is no longer sufficient that a machine be able mechanically to do the work for which it is designed. It must also do this work in the closest possible conformity with the conditions under which the railways must be operated. A railway is designed for the transportation of freight and passengers. All other operations, including maintenance of way, are secondary. Furthermore, the railways are constantly placing more emphasis on the regular unrestricted flow of traffic. It is becoming increasingly important, therefore, that the work of maintenance be done with the minimum interference with this traffic. This is placing added importance on the design of equipment that interferes little, if at all, with train movement. It is axiomatic also that equipment should be simple to operate as well as to maintain, for, as its use expands,

Highway Accidents

During the first 10 months of 1929, 1,982 persons lost their lives as the result of accidents at highway grade crossings, a reduction of 56 compared with the same period of 1928, according to reports just filed by the railways with the Interstate Commerce Commission. The number of persons injured in such accidents totaled 5,368, an increase of 2 per cent, compared with the corresponding period of the previous year. The number of accidents at highway grade crossings in this period totaled 4,713, compared with 4,585 in the first 10 months of 1928, an increase of 3 per cent.

The reduction in the number of fatalities at highway grade crossings occurred in spite of an increase of 13 per cent in the fatalities resulting from automobile accidents on all highways throughout the country and the further fact that there was an increase of 8 per cent in the number of automobiles in operation, indicating that a greater reduction is being made in accidents at railway crossings than elsewhere.

it must of necessity be placed more generally in the hands of the regular forces rather than under the control of men specially trained. To the extent that a machine is easy to operate, its acceptability will be increased.

Why Progress Has Been Slow

THE USE of power machinery in the maintenance of railway tracks and structures has lagged far behind the adaptation of labor-saving equipment to industry. The industrial revolution, which wrought such marked social changes in the civilized world, was set on foot soon after James Watt developed his steam engine. But it was more than a century later before even a start was made in the use of mechanical equipment of any kind in maintenance of way. In other words, real progress in the mechanization of maintenance of way work has all taken place long after water, steam and electrical power had become prime necessities in manufacturing.

This is no reflection on the railways or the officers in charge of maintenance of way, for, as will be seen, there is a distinct parallel between maintenance of way and other operations outside the railway field in which the change from hand labor to power tools took place at about the same time. Maintenance of track, which embraces upkeep, repairs and policing, may be compared favorably with street cleaning and repair, domestic housekeeping and the preparation and serving of food. Building maintenance on the railways differs but little from corresponding activities on buildings devoted to other uses, and it is not surprising that the various tasks which it entails should be performed manually as long as the construction of new buildings was a matter of hand labor.

There are many reasons why the classes of work embraced in these various categories were not readily reduced to mechanical processes. Foremost among these are the diversity of the tasks and the inherent difficulties of effecting the division of labor which characterized the industrial revolution of the nineteenth century. So long as one individual is required to perform many different tasks from hour to hour, it is impracticable to provide him with a power tool for each task. But there is an even more important reason for the delay in the introduction of labor-saving equipment in these fields. For fully 100 years after James Watt, the application of mechanical power was necessarily confined to such operations as could be performed by fixed machines, to which power could be transmitted through the agency of belts and line shafting, or to portable machines like the steam shovel in which the power demand was sufficient to justify provision for individual prime movers. The portable power units had to await two important developments: the widespread distribution of electricity through the agency of the public service companies and the perfection of the internal combustion engine, whereby direct mechanical power, compressed air or electricity may be supplied economically by prime movers of relatively small size. No better proof of this can be cited than the fact that the electric washer and the vacuum cleaner were introduced about the same time that the first power tools were employed in maintenance of way work.

It is not surprising, therefore, that the use of power in maintenance of way was a century late. Rather, it is worthy of note, considering the obstacles imposed, that so much progress has been made in so short a time. One thing is certain, the progress to date is but a beginning. However, exactly as the factory and the shop replaced the home and the individual journeyman in the field of manufacture, so also, marked changes in organization must be carried out before the mechanical tool will attain its true importance in the repair and upkeep of the fixed properties of the railways.

The Most Important Problem

FEW subjects are of deeper interest to maintenance officers today than those connected with the use of labor-saving equipment and the methods best adapted for securing the maximum benefits from its use. One of the indications that this is true is the recent action of the American Railway Engineering Association in creating a special committee to investigate the various phases of the operation and maintenance of work equipment. Another indication of the widespread interest and intensive study which are being given to this subject is found in the expressions of a number of maintenance of way officers, which appear in this issue, on the relative importance of some of the problems which are confronting them in the distribution and use of labor-saving machines.

While a wide variety of problems have been created by the introduction of machine equipment into railway maintenance, and, while the use of such equipment has reached the stage where it is taken for granted, few, if any, of the problems connected with its operation or the revision of methods thus made necessary, have been finally solved. In any widespread operation, such as roadway maintenance, it is to be expected that certain phases of the general problem will assume greater importance than others. It is to be expected also, that in any discussion of the subject, there will not be complete unanimity as to the relative importance of these problems, since the conditions which must be met differ widely in various sections of the country and even on individual railways.

It is of interest to note, therefore, that, while there is no general agreement as to which of the problems is most important, there is unanimity in the conclusion that the major problems include the original selection of the equipment, the programming of the work in such a manner as to insure that the equipment will be kept busy, proper arrangements for its repair and maintenance, and the training of operators to get full capacity out of the machines and at the same time keep them in the best possible condition. It is also agreed that all of these phases of the general problem are so interdependent that failure to give due consideration to any one is certain to result in inefficient use of the equipment and cause a measurable loss to the railway. Three officers also mention a reluctance on the part of the local supervisory officers and men to use the machines to the fullest extent possible, and say that organized effort on the part of general officers is often necessary to correct this attitude.

Whatever may be the belief as to the most important problem, or the relative importance of the problems facing railway officers in the use of labor-saving equipment, it is clear that the whole subject is in a state of flux, for the reason that the introduction of this equipment is so recent that its de-

velopment and use are still in the initial stages. It will require intensive study and wide discussion before the various problems become sufficiently stabilized to be capable of complete solution.

Obsolescence

BECAUSE of the fact that most of the railways have only recently undertaken to provide mechancal equipment for their maintenance of way forces on any extensive scale and because they are still so far short of fully equipping their forces, the problem of retiring this equipment by reason of its obsolescence is not yet considered an acute one on most roads. Yet the development of maintenance of way work equipment by the manufacturers is so rapid, and utilization by the railways is proceeding at such a pace that the question of obsolescence is not so remote as it might seem at first thought. Indeed, with such equipment as motor cars it has become a most important problem.

Obsolescence has seemingly been a difficult principle for the railway managements to comprehend. So long as a locomotive, a piece of equipment or a machine has been able to operate, it has been continued in service, even though the cost to operate it was much higher than for more modern units. In other words, it has been operated until it has worn out. This has left many men and many departments with operating burdens that even the greatest ingenuity and enterprise could not overcome. This attitude stands out in sharp contrast with that of certain other industries, notably the electrical industry, in which equipment has been scrapped with little reference to its physical condition, in order that it might give way to more modern and more efficient units. By this means production costs have constantly benefited from the latest developments in the industry.

If maintenance of way officers are to profit most from developments in mechanical equipment, they must be as alert to replace equipment already in service by more modern units, as they are to accept such devices in place of hand labor, whenever the savings yield an adequate return on the additional investment. The problem is not primarily one of first cost, but of the return that can be earned on this cost.

The railways have never spent so freely for improvements designed to reduce operating expenses as during the last five years. At the same time they have never been operated so efficiently as during the last few years. These economies have been made possible in large measure by the large capital expenditures. That they have been made wisely is not open to question.

This attitude towards expenditures needs to be transmitted down through the maintenance of way organization. It is not enough to accept machines that will demonstrate their economy by replacing manual with mechanical means. We have now reached a point where there are probably equal opportunities to replace machines already in service with newer and more efficient machines, and effect savings sufficiently large to permit retirement of the older units and still pay handsome returns on the newer equipment. Such a practice strikes at the long established policy in railway service of retiring equipment only when it is worn out or when repair costs become prohibitive. The question is not now whether one can afford to scrap such a unit, but whether one can really afford to operate it, even though it may still be capable of rendering years of service.

Every unit of railway work equipment now in service, if of other than recent purchase, should be subjected to analysis of this sort. When the work equipment budget comes up for consideration each spring, such a study offers opportunities for further economies in the conduct of maintenance of way operations approaching those realized from the initial installation of the equipment that is now obsolescent. As pointed out by C. J. Geyer on page 124, it is a problem that is rapidly becoming of increasing importance to maintenance of way officers.

Overcoming Inertia

THE use of labor-saving equipment in roadway maintenance has increased so rapidly in the last decade that many roads now consider this a normal practice. The introduction of this equipment has necessitated important changes in the methods and practices which have been followed heretofore, and its influence on the men who are concerned with its use has been very great.

The first and most direct effect is a reduction in the physical effort that is required. For example, the locomotive crane and the rail-laying crane have practically eliminated heavy lifting in handling and laying rail, in placing frogs and crossings and in the application of other heavy materials. The ditching machine has likewise released large numbers of men from the necessity of working under difficult and undesirable conditions. These are only two examples from a long list that might be cited to show how much of the laborious is already being taken out of roadway work.

In view of this fact, it might reasonably be expected that the local supervisory officers, as well as the gang foreman and men upon whom the brunt of these tasks fall, would welcome the introduction and use of machine equipment. The human mind is peculiar, however, and men are reluctant to change their habits of thought and action, even to the point of obstinacy. As one writer in this issue has expressed it, "Inertia is not alone a property of matter, but prevails quite frequently in the human mind." The result of this mental characteristic is that maintenance officers often find considerable reluctance on the part of their local supervisory officers and men to use the equipment which is provided for them.

When this situation arises, as it frequently does, it is a serious mistake to meet it with the force of authority, since such action will usually crystalize any doubt which may exist as to the advantages of using the machine. It requires tact and patience to induce a man to do a thing which he objects to doing, whatever the basis of this objection may be. Furthermore, if he is compelled to use a machine under protest, he immediately develops a prejudice which is still more difficult to remove. In this frame of mind, he is apt to find fault, and certainly will not use the machine to its full capacity or maximum efficiency.

The better way is to use persuasion and educational methods. Where this practice is followed, reluctance to use the equipment will usually give way to enthusiasm until frequently, the only objections which must then be met are based on the necessity of releasing it for use elsewhere in compliance with the schedule of work.

Driving Track Spikes—
The old and the new

What *of the* Future?

An analysis of the trends in the use of labor-saving equipment and of the opportunities for further savings

By R. H. FORD
Assistant Chief Engineer,
Chicago, Rock Island & Pacific, Chicago.

AMONG the striking changes which have marked the great advance in railway performance during the past few years, those which stand out most prominently are the improvement in freight movement and the use of machinery in maintenance of way operations. More than 80 per cent of the freight handled by the railways is now moved on time freight schedules, as compared with about 30 per cent before the war. This represents almost a revolution in practices heretofore existing in train operation. In importance, it compares favorably with the changes brought about by the use of labor saving devices in maintenance of way work, whereby the railways have been able to release permanently a large number of unskilled laborers. This latter change in practice has resulted in a two-fold advantage: A reduction of maintenance costs and an ability to use heavier and more satisfactory materials in building and maintaining the track structure. Without these mechanical aids, it would be impossible to operate and maintain the railways to their present standards of excellence.

The Field Is Large

According to the reports of the Bureau of Railway Economics for 1928, there were 407,350 employees in the maintenance of way departments of the Class I railways, of which, in round numbers, 335,000 were classed as common and semi-skilled labor and 72,350 as skilled and supervisory labor.

As most of the employees of this department are engaged in work which is susceptible of adaptation to mechanical methods, these figures indicate that one of the most important opportunities for reducing the cost of transportation still lies within the maintenance of way department. This branch of the service affords great possibilities for initiative and resourcefulness, through the consistent development and ultimate substitution of modern mechanical means for unskilled manual performance. Proportionately, also, there is afforded greater opportunity for versatility among the supervisory and skilled labor forces, which, in the natural course of events, will become increasingly necessary.

It is for this reason that the maintenance of way department of the railway offers such an excellent opportunity for young men with a proper background, this being especially true on the roads whose methods of selection and training are similar to those in effect in other major industries. While such a system of selection and training requires more liberal methods in developing personnel than are common on most railways, lowered costs as well as improvements in transportation are certain to result, through the substitution of modern mechanical methods for existing practices of unskilled manual performance. Since approximately 78 per cent of the total expenditures for maintenance of way and structures are made directly on the right of way as contrasted with charges for overhead, supervision, etc., this is an exceedingly attractive field for railway managements to study.

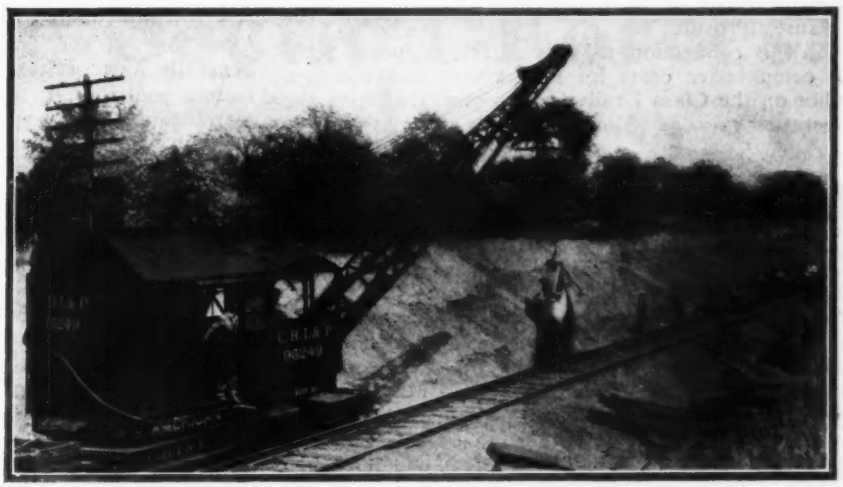
These facts serve to explain the trend, which is evident on certain railways, towards broadening the field of modern research along more scientific lines than has heretofore been the practice. Recently,

there has also been a closer relationship between the railways and the universities, in the use of their laboratories and research facilities.

Until quite recently, the railways have depended almost entirely upon the manufacturers of railway supplies for research work. In this way, most of the improvements in labor saving and similar appliances used in maintenance have been developed. Of necessity, developments made in this manner cannot always be as complete and far reaching as the circumstances demand, because outside interests lack adequate information and the ability to bring about adjustments in personnel and methods, which form such important factors contributing to the successful use of machines as contrasted with manual methods.

For various reasons, it is difficult for those outside of railway service to become intimately acquainted with all of the elements of cost which enter into manual operations and their consequent current practice in railway maintenance. For this reason, organized internal research, in co-operation with the manufacturers and the university laboratories, has become increasingly important.

It would seem that the time has now arrived when the more backward railways, generally, will have to follow the more enterprising and progressive leaders in this field, if they are to take advantage of lowered costs in producing transportation. Many maintenance of way officers are becoming increasingly alert to the opportunities that lie in the more scientific development and utilization of labor-saving devices, and the adjustments in worn out methods and practices, which the successful use of these machines so frequently requires.



The extensive purchase and use of equipment such as this are introducing a new day in maintenance of way

Manufacturers Should Study Railway Methods

With the increased use of mechanical appliances, there have come onto the market numerous useless and improperly designed contraptions. Many of them have little or no value, and the expense of development and experimentation which they have required could have been saved if those concerned in their design and promotion had been better informed, in the first instance, relative to the objectives which they are seeking to accomplish. In many instances, they are apparently ignorant of the fact that, as yet, the majority of the persons to whom the use of these facilities must necessarily be entrusted, are unskilled laborers.

Many manufacturers and others concerned in the manufacture of mechanical devices fail to appreciate that the classification of accounts required by the Interstate Commerce Commission, was not designed as a cost keeping system, and that, in the railway business, it is difficult to get actual comparative costs of present-day performance, except through scientific research. There is no better illustration of this difficulty than the fact that, for nearly twenty years, the Division of Valuation of the Interstate Commerce Commission has been endeavoring, without success, to determine what it is costing the railways for track laying and surfacing.

Simplicity Is Essential

The design of a satisfactory machine, for use in railway maintenance, demands, first of all, simplicity, together with standardization and interchangeability of parts wherever possible, with equivalent simplicity of operation and maintenance. While there will be a gradual decrease in the number of common and unskilled laborers on the railways, and a substitution, to the extent necessary, of skilled labor and increasingly intelligent supervision, this movement is barely started today. Ultimately, greater refinements in practices and methods of operation will be possible, with a corresponding increase in efficiency and greater diversity in the use of machine equipment. For the reasons given, however, the conditions for developing a successful maintenance machine for general railway use are not necessarily the same as in other lines of industry.

One of the difficulties encountered in the introduction of maintenance of way machinery is the apparent unwillingness or inability of manufacturers to standardize comparable parts, as for example the wheels, axles and small parts of track motor cars, which are now used universally by the railways. Similar standardization in other forms of maintenance of way machinery is also desirable.

While the field for labor-saving devices is yet largely unexplored, the development has gone far enough to justify the overhauling of practices in the track units, which still remain much as they were 50 years ago. For instance, a section gang of from 4 to 12 men still maintains approximately four miles of main and other tracks, under the direction of an isolated track supervisor, who has charge of a district approximating 125 miles.

In addition, there are numerous other unrelated

maintenance units, variously classified as bridge building, paint, telegraph, signal, water service and other gangs. These men pass and repass over the same territory, under separate supervision, to perform special unrelated work, the accomplishment of which is usually out of all proportion to the time expended in going to and from the job, with a corresponding waste of time, plant investment, etc.

Elimination of Scattered Units

The introduction of labor saving devices in maintenance of way is tending toward the elimination of these scattered units and the substitution of a combined, and consequently smaller, organization of specially trained and qualified men, equipped with those modern appliances which are found essential for efficient maintenance. Practices of this character will permit scheduling jobs, and will require only a suitably equipped policing force for service in connection with safety and the protection of the line.

Modern methods of communication, quickened, dependable; ready access to the work; standardization of practices, with a wider use of self-contained power machines; these, when coupled with originality and courage, should serve as a forceful urge on maintenance of way officers to take advantage, experimentally if necessary, of the opportunities which so clearly point to large savings, with a corresponding effect on railway costs. Greater efficiency in supervision and simplicity of management will be sure to result.

In this connection, a study of the following table of comparative costs for supervisory and common labor on the Class I railways, as compared with the operating ratio, is of interest:

Year	Average Yearly Wage Section Foremen	Other Trackmen	Operating Ratio Per Cent
1900	$ 530	$382	.....
1910	623	460	68.63
1914	689	498	72.22
1920	1,740	1,179	89.17
1925	1,500	876	75.57
1928	1,558	873	74.56

For convenience in considering the use of mechanical devices for maintenance of way work, the following divisions can be made: (1) Material handling equipment; (2) machines for ditching, restoring banks and right of way work; (3) track-lining and surfacing machinery; (4) rail-handling machines; (5) weed-destroying and weed-cutting machines; (6) bridge-maintenance machines; (7) painting and other machines used on buildings and structures; (8) signal devices and machines; (9) ballast-cleaning machines; and (10) telegraph, telephone and fencing machinery. To these can be added, although they are in a different class, (11) maintenance of way track tools, with a still further classification, which will follow as result of the use of mechanical devices, of (12) a better grade of materials, the latter being made possible through the use of machines in place of manual operation.

The ditching machine is an example of what may be accomplished in the use of labor-saving equipment. A few years ago, all work of this character was done by hand. Today, practically all of the railways are equipped with ditching machines, and at least 90 per cent of this work is done by machinery in a much better and more satisfactory manner than was possible by hand labor. This class of machinery has resulted in the release of thousands of men formerly engaged in work of this character.

While distinct advances have also been made in the use of mechanical and chemical means for weed-cutting and destruction, a more comprehensive study of these problems will prove beneficial in promoting even greater savings and better maintenance as well.

The treated tie and the tie plate, together with the use of adzing and boring machines, have greatly increased the stability and improved the alinement and gage of the track while eliminating the slow and uncertain process of hand adzing, with its wasteful and murderous effect on the track tie. On the other hand, the necessity for more stable track has increased the use of heavier rail and fastenings, thus requiring increasingly better machines and machine tools.

Tie Renewals Still Made by Hand

One of the unexplored leads is the application of ties by machinery. The total number of ties in service on the Class I railways approximates one billion, requiring an annual renewal of nearly 100,000,000, making a total labor cost for renewal of more than $30,000,000 and requiring the expenditure of 12,000,000 man-days. All of this work is done by common labor. It is within the range of practical possibility that, ultimately, machine methods will partially, if not entirely, do this work and if machine methods for ditching afford a criterion the work will be performed in a more satisfactory and efficient manner. Great possibilities lie in this direction.

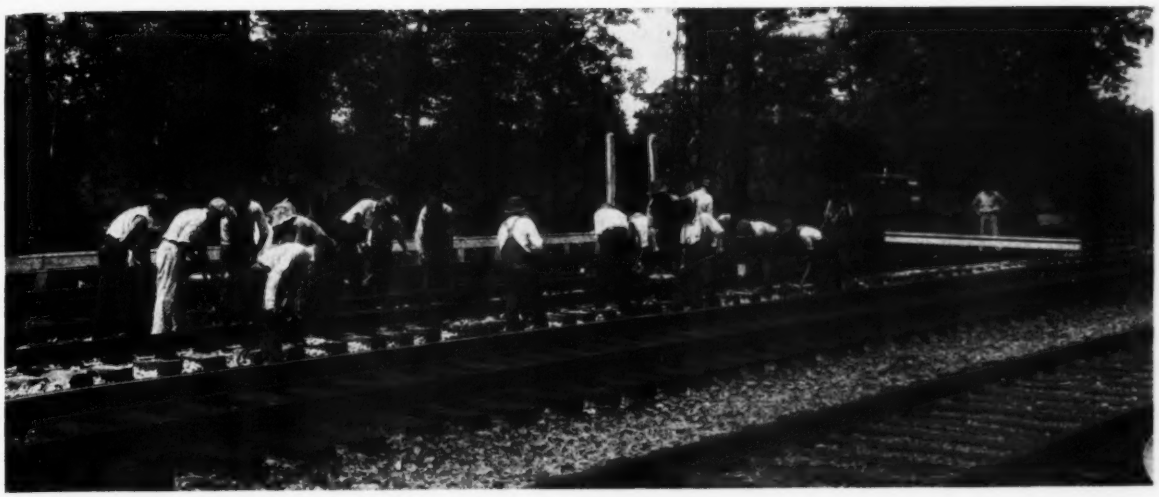
A greater amount and a better quality of ballast forms one of the greatest needs of the railways generally and, of itself, forms one of the principal factors contributing to greater economy in railway maintenance and operation. Here is a splendid opportunity for improvement and cost reduction in the manner and method of producing and applying ballast. While there have already been some notable advances in this direction, a critical study will suggest the belief that they are indicative, rather of future possibilities, than otherwise.

Avoid Interference with Trains

The improvement in the freight movement to which reference has been made, with its corresponding increase in speed and on-time performance, makes it necessary that maintenance machinery of the future shall be so designed as to require as little interference as possible with traffic. This fact alone should impress maintenance men with the possibilities of the motor tractor and caterpillar type of machinery, using internal combustion motors for power.

This also suggests an increasingly greater use of the right of way for these purposes, with the possibility that, in certain districts, a maintenance roadway might be utilized within the right of way, instead of using the main tracks for maintenance operations and local material distribution.

It is well worth the time of maintenance officers to make a study of shop methods and practices in a modern machine shop, or of the automobile industry. They afford striking comparisons of the waste of time paid for but not used on many railroads, owing to the necessity for safety requirements and non-interference with train operation. This is labor wasted, which encourages inefficiency and decreased responsibility. Correspondingly, therefore, there will come an increase in efficiency and a decrease of costs, by properly constructed mechanical devices, which can be operated continuously, without requiring the use of the main tracks.



The 12-tool Tamping Outfit Is Particularly Effective with the Larger Section Gangs

Why Neglect the Section Forces?

Lackawanna finds it just as practical to provide its regular gangs with labor-saving equipment as to equip its large extra gangs

WITH the present day large scale maintenance operations on the railroads and the incentive created thereby for record production, so many roads are concentrating their attention upon the organizing and equipping of large maintenance of way gangs for specific work, that there is sometimes a tendency to overlook or neglect the smaller, but no less important, unit of the maintenance forces—the section gang—and to fail to see that it is also equipped suitably to carry out its work in an effective and economical manner. Many factors contribute to the tendency to neglect the section gang, some of which may be justified, but in this day of high material and labor costs, neglect or inattention to section forces, which involve such a large number of men, is justified only after it has been seen that these forces have been suitably equipped with the most effective mechanical aids to carry out their work, and then carefully supervised to insure that they are functioning properly and using their equipment in the most effective manner.

On most roads, regardless of the amount of heavy work which is done by extra gang forces, the section gangs still constitute the backbone of the maintenance of way department. The men employed in these gangs usually far outnumber the total of those employed seasonally in large extra gangs, and almost invariably they are of a more reliable and industrious class and much more capable of using mechanical equipment properly. Despite this, with the more general adoption of labor-saving equipment and devices during the last five or ten years, there has been a growing tendency toward the concentration of effort on big extra gang organizations, and to overlook and deprive the section forces of the needed mechanical aids necessary to develop their greatest efficiency.

Large Outlay of Mechanical Equipment

A road which has gone far in the use of labor-saving equipment is the Delaware, Lackawanna & Western. For years this road has been one of the pioneers in the development and use of such equipment, and it is today possibly as well equipped as any other road to carry out its maintenance work in an expeditious and economical manner. The more important units of labor-saving equipment used by the track department of this road include the following:

Four and twelve-tool pneumatic tie tampers
Pneumatic tie-boring machines
Pneumatic screw spike wrenches
Pneumatic cut spike drivers
Pneumatic rail drills
Pneumaitc grinders
Steam shovels
Locomotive cranes equipped with clam-shell buckets and magnets
Small power derricks for handling miscellaneous track materials
Spreaders
American ditchers
Mole ballast cleaners
Ballast screens
A tie-scoring machine
A track oiler
Oil and steam snow melting systems
Snow plows

Snow and ice flangers
Track dollies
Section and extra gang motor cars
Tool grinders
Track liners
Acetylene cutting and welding outfits
Mastic mixers

Section Gangs Are Not Overlooked

The Lackawanna has found a large place for the effective use of extra gangs and special work organizations for carrying out such large items of work as rail laying, ballast cleaning, ditching, etc., and, as indicated by the above list of equipment, it equips these special organizations with all of the facilities necessary to insure that their work will be done in the most economical manner. At the same time, however, it has never lost sight of the value of the section forces and of the importance of getting as much in return for each man-hour of section labor as from each man-hour of extra-gang labor. Thus, while much of the above equipment is assigned for use by extra-gang forces, sight is not lost of the fact that there are from 1,700 to 2,600 employees in about 260 main line, branch line and yard section gangs, whom it is at least as important to equip properly with suitable mechanical aids to carry out their work in an efficient manner.

The factors determining the character and amount of labor-saving equipment to be furnished to the maintenance forces of the Lackawanna are considered to be largely the same, whether pertaining to large extra gang forces or to the regular section forces. In the first place, it is recognized in either case that the purchase and use of labor-saving equipment is justifiable only to an extent consistent with the economies to be secured from such equipment. It recognizes also, in both cases, that owing to the cost of labor-saving equipment, it must not only be capable of effecting economies in itself, but it must be kept in operation a sufficient amount of time yearly to justify the initial expense involved. It recognizes further that care must be exercised in the selection of labor-saving devices and equipment, not only to insure that they are perfected and practical, but that they meet the peculiar requirements of their road.

Standard of Maintenance a Factor

In addition to these considerations is the recognition of the further fact that the standard of maintenance desired, and the character of the line and the volume of traffic over it, exert an important influence on what equipment is adapted or economical; that the men must be carefully instructed in the use of the mechanical equipment furnished to them, and that closer supervision is required; and further, that suitable means and facilities must be provided for the proper and economical maintenance and repair of all equipment, tools and devices purchased.

Taking all of these factors into consideration, the Lackawanna has found it just as practicable and important to give attention to the proper equipping of its section forces as to see that its larger work organizations are properly fitted with labor-saving equipment. With many of the major items of maintenance work now handled by large specially-organized forces fully equipped to perform work as economically as possible, which has thereby reduced the regular section work more and more to a "finishing-up" work, making refinements in the track structure, doing miscellaneous roadway work and patrolling, it is not expected that the equipment of the section gangs on the Lackawanna, either individually, or as a whole, is as large and impressive as that used for the heavier out-of-face work carried out by the large special organizations. In fact, the equipment furnished to the section forces is actually cut to a minimum consistent with the work of these forces and the economies which can be effected.

The problem in determining what labor-saving equipment should be furnished to the individual section gangs has been presented largely by the large number of gangs to be equipped, the great expenditure involved in suitably equipping these gangs, and the fact that in many cases the individual sections have not sufficient work of a specific nature to warrant the large expenditure necessary for units of special equipment, even though that equipment may facilitate the limited work on the section as it is actually carried out. The Lackawanna, like a number of other roads, has overcome these obstacles in one principal way; purchasing labor-saving equipment for the section forces on the basis of the needs of the section forces as a whole, and then assigning the equipment to one or more adjoining sections, or pooling it among the sections on the different roadmasters' territories for use by the different section gangs as they may have need for it. Thus, for example, every second main line section, with the exception of seven double sections, is equipped with a four-tool air compressor and pneumatic tie tamping tools. In addition, branch

Air Drills Are Used to Bore All Screw Spike Holes

line sections having stone ballast are also equipped with tie tampers. In the use of this equipment, two sections work together to the extent that they so plan their surfacing work that one section will be putting a final surface on its track with the power tampers, while the other section is engaged in other work or in making a preliminary raise of its track and shovel tamping it up.

Each of the double sections on the Lackawanna, which are being experimented with in an effort to determine the relative effectiveness and economy of the larger section as compared with those of normal size, is equipped with a complete 12-tool tie tamping

outfit. Owing to the size of these sections, and their larger forces, the larger unit of equipment is entirely practical and, because of its greater capacity and its adaptability to many operations other than tie tamping, it is proving itself much better suited to the large gangs than two or three of the smaller size.

Equipping the section forces with tie tampers dates back 17 or 18 years on the Lackawanna, and is not an entirely new practice on several other roads. Nor is the Lackawanna's practice of equipping each section with a motor car and a tool grinder novel, but it is unusual to find section forces regularly equipped with such units as power drills and power spike drivers, as is the case on the Lackawanna. Here, however, there is justification for supplying this equipment, the regular section forces being required to drive all of the screw spikes used in connection with rail renewal operations.

All of the normal size main-line sections have the use of four-tool tamping outfits

A New Standard of Spiking

In changing to a heavier section of rail having a six-inch base instead of the old base of 5⅜ in., and with a corresponding increase in the length of tie plates, the Lackawanna has adopted a new standard of spiking which normally calls for two cut spikes to hold the rail and two screw spikes, in diagonally opposite corners of the plates, to hold the plate securely to the tie. The carrying out of renewal operations requires, therefore, not only the renewal of the rail and the plates, but the reboring of the ties.

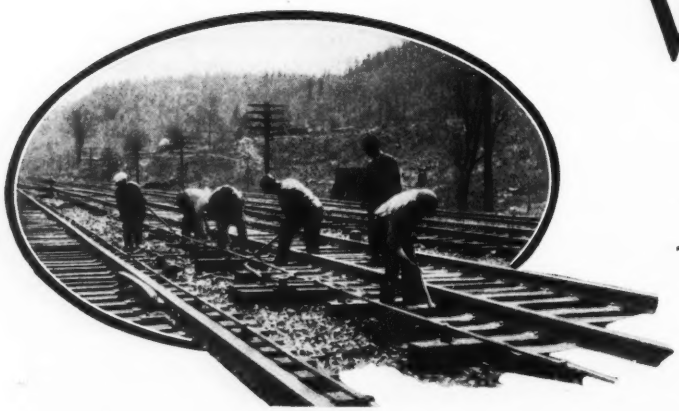
All of the most up-to-date labor-saving equipment is used in this rail relaying work, even to the use of pneumatic cut-spike drivers, and all of the operations are completed by the specially assembled large rail laying forces, except the boring of the holes necessary for the newly located screw spikes, and the driving of the spikes themselves. These latter operations are done by the regular section forces, following up the rail laying as closely as possible and, in large measure, account for the fact that there are 93 power wood borers and a similar number of power screw-spike drivers distributed among the section gangs. These tools are operated by the 4 and 12-tool tie tamper compressors, which are available to all sections having need of them, and while the 93 borers and spike drivers are not equivalent to one to the section, the tools are definitely section gang equipment and are distributed among the different sections as their work may require.

Other labor-saving equipment furnished to those sections requiring it, or to those sections where it can be used most effectively, includes track liners and snow melters, and still other equipment made available to the section forces when needed, but assigned to a roadmaster's territory, includes cut-spike drivers and rail drills. By so allotting the equipment on the Lackawanna, each section gang is furnished outright that for which it has sufficient use to justify the expenditure and has access to other labor-saving equipment and devices whenever the magnitude of its work makes it advisable to employ the equipment.

Having had years of experience with mechanical equipment, the section foremen on the Lackawanna have become more or less mechanically minded and are in a receptive mood to apply and get the most out of the equipment furnished to them. However, the closest of supervision is exercised to see that the equipment furnished is used to the greatest extent possible and in the most effective manner.

Maintenance of the equipment, both that furnished to extra gangs and to the regular section forces, is in accordance with a well-defined plan, which begins with the foreman and includes a well-developed system maintenance shop. Each foreman is held definitely responsible for the care and operation of the equipment assigned to him or employed under his direction, but he is assisted when necessary by mechanical supervisors and their assistants, who travel over the road and are on call for making such field adjustments and repairs as may be required. During the winter all air compressors, and such equipment as may require special attention, are sent into the mantenance-of-way shop at Dover, N. J., where up-to-date facilities in charge of skilled mechanics are maintained to make all classes of repair to the equipment, even to completely overhauling it if necesary. Following the repair of the equipment, the various units are painted, if this is necessary, and are stored under cover for the winter.

Owing to the many factors which enter into maintenance-of-way expenses, it is difficult to determine definitely in dollars and cents the actual saving which the employment of labor-saving equipment has brought about, and more particularly, the saving effected by the equipment furnished specifically for section gang use. That savings can be effected with the various units of the labor-saving equipment purchased by the Lackawanna, however, is definitely established before purchases of any magnitude are made, and the savings that are being effected with the equipment are checked from time to time by comparing the costs of the various operations.



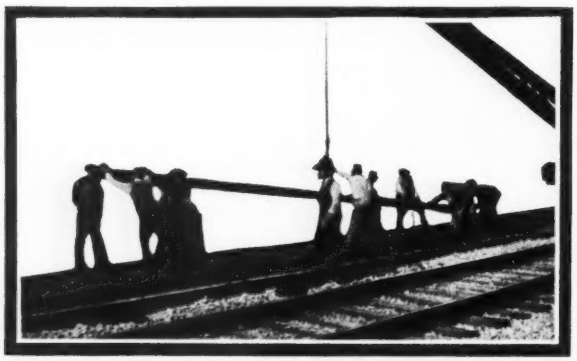
What is the ... in Applying

Is it the selection of the appliances, keeping them in repair or at work, training the operators or some other phases of the subject that demand major consideration?

THE introduction of machine equipment to replace the slower and more inefficient methods of hand labor has created a wide variety of problems which must be met and solved by maintenance officers, whether they have a direct or only an indirect responsibility for the operation of this equipment or the results which are obtained from its use.

Much has been said and written on the individual problems which have arisen through the changes in practices which are a necessary accompaniment of the new era in maintenance. The importance of reorganizing methods to adapt them to the new conditions is generally recognized, and this subject has been studied intensively by every railway, with a view of producing the best results from the investment they have made in the machine equipment. Despite these studies, however, many instances are known where the machines have been employed so inefficiently that the benefits derived from their use have not been commensurate with their cost, while, in some cases, there has been an actual loss.

Every labor saving machine represents a definite investment, and certain fixed charges, such as interest, depreciation, amortization and maintenance, accrue against it constantly, regardless of the use to which it is put or the amount of time it stands idle. For these reasons, a minimum period of operation and definite economic benefits from its use must be obtained in order to justify its purchase. In order to bring out the relative importance of these problems which have arisen as a result of the changes in methods which are still taking place, several prominent maintenance officers have been asked to give their views as to what constitutes the most important problem which they and other railway officers have to face in the use of labor saving equipment today.



The Number of Men Serving Machines Must Be Studied

While there is not complete unanimity as to what constitutes the most important problem, it is made clear that the various problems in the use of labor saving equipment are closely interwoven, and that the failure to arrive at a proper solution of any one of them may lead to inefficient use and consequent loss to the railway. It is also brought out that every phase of the selection, supervision and use of the equipment must be co-ordinated, and constant vigilance exercised, in order to obtain the maximum use and, therefore, the maximum benefit from the investment in the various units of labor saving equipment. The views of these officers follow.

Instructing Field Forces Is Most Difficult Problem

By Bernard Blum
Chief Engineer, Northern Pacific, St. Paul, Minn.

LABOR-SAVING equipment for railway maintenance is an important item in the problem of reducing operating costs. The pressure on one side, to reduce rates charged by the railway, combined with the almost constant appeal for increased wages on the other, requires that the total cost of the work performed be held at least to a level that will permit a net return at the end of the year. Savings in maintenance work fall under the heads of either material or labor.

A very definite and marked economy has resulted from improved conditions and the use of better material, such as improved drainage, widened subgrades, more and better ballast, larger and treated ties, heavier rail and fastenings. Under the head of labor saving, it has worked out that the use of improved and heavier material has automatically resulted in a decreased requirement of man hours, both for replacement work and in the ordinary duties of section work.

With the increased use of machinery in the shops, the development of tools for track and building work followed naturally. It appeared at the beginning of this develoment, that the equipment would be welcomed, on the part of the men, for the decreased physical effort required; on the part of the foremen, because it would attract a better class of men with whom they would have to deal; and on the part of roadmasters and track supervisors, since it would

Biggest Problem

Labor-Saving Machines?

reduce the cost of their work and the time required for completing programs.

The labor saving equipment that is in common use on many Class A railroads, and which, generally, is well supervised, has demonstrated the economy that can be derived from its use. Notwithstanding this, there arises frequently the serious problem of getting crews to use such equipment to the fullest extent that is possible. Inertia is not alone a property of matter, but prevails quite frequently in the human mind. It is recalled that, when a device was first introduced for lifting rails into place, resulting in the elimination of a number of tong men, the foremen frequently argued that they could do the work as well with the usual number of men with rail tongs, even while admitting that the machine would save a number of men and a large amount of heavy hand lifting. That same attitude is sometimes encountered today, and presents a problem that must be taken into account in any proposal to begin or extend the use of machine equipment.

Unless the costly machines which are provided, are used intensively and with judgment, the savings are overbalanced by the items of interest and depreciation that go on hourly, whether or not the equipment is in use. To keep the equipment at work and operating in the most efficient manner, requires careful supervision. It is not sufficient to assign a piece of equipment to a gang with, possibly, some general instructions as to its operation, and leave the operator and foreman to get along as best they may. Minor difficulties frequently occur and, if the supervising officers are lukewarm in their interest, such difficulties serve as an excuse to lay aside the tool and revert to the former hand methods.

The supervisor of maintenance of equipment has, therefore, an important duty to perform, to instruct the field forces, as well as to maintain the equipment in good working order. It may be stated that the former is the more important, especially when the equipment is new and untried. It will be observed that, when proper co-operation is received from the field forces, delays caused by the need for minor adjustments are quickly ended, whereas lack of proper interest, and in some cases direct opposition, serve to magnify mechanical difficulties. Lack of co-operation also frequently results in damage to the equipment.

The necessity of adequate and proper supervision of the use of equipment, makes the selection of the supervisor of maintenance of equipment an important matter. The supervisor, in order to fulfill the requirements of his position, must be not only of a mechanical turn of mind, but should also be versed in the most modern methods of performing work. There is a large field for him, in the development of new methods and new types of machines, to perform work for which equipment has not yet been devised. With a man of this type at the head of the maintenance of equipment department, the inspiration and enthusiasm which he will impart to the track and building supervisors will, in turn, be reflected in an increased interest in labor saving devices on their part.

Without doubt, the use of labor saving equipment has become a normal part of railway activity. A large number of manufacturers have invested their capital in plants for fabricating tools to benefit the railways of the world. These investments were made only after it was clearly demonstrated that labor saving machinery was of great value to the railways. The pioneering work which the manufacturers have done is worth a proper reward and it has been amply demonstrated that there is sufficient margin to reward both parties.

The greater the use that is made of an individual machine, the sooner the user will obtain an adequate return on his investment. This requires that each subordinate officer work out every labor problem and determine to what extent equipment and tools can be used to the best advantage. The present indications are that the various railways are recognizing this problem and are successfully meeting it. It requires earnest attention, however, from engineers and maintenance of way officers, and eternal vigilance to know that equipment is being used to maximum capacity and to maximum advantage at all times. The results which have been obtained in the past, however, give every hope that this matter will be met and successfully worked out without undue delay.

Planning and Organization Are the Keys to Efficiency

By W. J. Backes

Chief Engineer, Boston & Maine, Boston, Mass.

THE KEY to the whole labor saving situation is the supervisor of work equipment. This officer should have the training of a mechanic; he should have a knowledge of internal combustion engines and be able to operate every type of machine in service. In addition, he should also have a background of railway experience, in order to be informed of the necessities and demands of transportation service

An Opportunity for Saving Labor Here

and of safety requirements. If such a man has a reasonable amount of inventive ability, so that he can devise new apparatus or modifications of that in use, of such a character as will increase its efficiency or adaptability, his value to the railway will be greatly increased.

Having procured such a man, the most important problem which maintenance officers are required to face, is that of organizing and planning the operations which are to be carried out with the machine equipment. The first step in any program of this character is the proper selection of the equipment as to type, as well as the particular device of any type. In my opinion, however, if an experienced supervisor of equipment has been selected, this matter will nearly take care of itself. After the equipment is in service, the ability to keep it busy will depend entirely on how thoroughly the year's work is planned, and the question of how closely this program is followed.

Those roads which have a sufficient amount of machine equipment, must, of necessity, maintain an organization which will keep it in condition to enable it to produce the maximum amount of work. Whether this is accomplished, however, will depend somewhat upon the ability of the men who are operating these machines. At present, a supply of trained operators is secured through the practice of training understudies for the regular operators, and I do not believe this phase of the labor saving problem is as serious as it was 10 to 15 years ago.

I would emphasize that adequate planning of the work, a proper organization and a suitable record of performance are the keys to obtaining the maximum efficiency from work equipment.

Biggest Problem Is to Get Sufficient Annual Use

By A. C. MacKenzie

Engineer Maintenance of Way, Canadian Pacific, Montreal, Que.

THERE are several problems in the use of labor-saving equipment, all of real importance, which correlate and dovetail into one another so as to be interdependent.

The selection of types of equipment which will effect material savings in labor is not a difficult matter, but to establish the particular type and make which will best suit requirements, which will be most flexible in its application, simplest in operation, most rugged in construction, and with the lowest maintenance cost over a period of years is a more difficult problem, confronted as we are with the high pressure salesmen of each manufacturer, all setting forth their specifications in a confusing variety of ways with a view to focusing attention on the main selling points of their particular designs. Many manufacturers and their salesmen are inclined to give much informative detail on the main selling features involved, leaving to the imagination the mass of detail which is necessary for the proper selection of the most suitable make of equipment.

The problem of keeping equipment in repair is not a serious one, and is more than half solved when the right type of operator has been chosen, in the case of larger machines, and when the right type of maintainer is chosen in the case of smaller and more generally distributed devices. But the most intelligent and efficient general supervision cannot overcome a mistake made in the choice of a poorly trained operator or maintainer. The annual overhaul of equipment is most important. It must be very thorough and should be done under qualified supervision, to insure continuous operation during the following season. It is not profitable to put machines into just good enough shape, so that with reasonable luck and care they will, with a struggle, be able to finish up the season. They should finish the season in good working condition and then it should be decided what general repairs are to be made.

The biggest problem in the use of labor-saving equipment is to get sufficient annual use out of it to make the greatest possible saving through its use. To that end, every effort should be made to lengthen the working season to the longest practical limits and increase in every way possible the uses to which any particular item of equipment can be put. The results from such an effort are not only reduced overhead but increased efficiency from the operators. Such a system attracts the best labor available, since it enables the railway to assure full-time employment for the greater part of the year.

Some Operations Must Necessarily Be Performed by Hand

The effect of continuous operation on overhead is quite appreciable. Plant overhead, in which should be included interest on investment, amortization and annual repairs, is a large item and must always be included in calculating the economics of any labor-saving device. As an illustration, it may be stated in round figures that the daily overhead against a tie tamping outfit will be approximately 14 per cent of the total cost, if operated for 100 days in the year, while, if the outfit is worked 200 days, the overhead will be reduced to approximately 8 per cent of the total cost. It is quite possible to work a tie tamper for 200 days a year and frequently a great deal longer, if its application is developed to include other items of maintenance work for which it is adapted, and in which it can be used economically.

With the object in view of reducing the overhead expense per unit of work accomplished, the purchase of labor-saving equipment with a single limited use should be approached with caution, and the possibility of adding auxiliary equipment to the main unit in order to obtain continuous use should receive very careful consideration. For example, under certain conditions, it is doubtful if the purchase of a pile driver, the use of which is practically limited to pile driving, is economically sound, and it might be wise to consider the purchase of a machine which will combine pile driver leads, clam shell bucket, magnet, drag line attachments, etc., thus opening up for it a wider variety of work, more continuous employment, greater general economy and reduced overhead.

Keeping the Equipment Busy After It Is in Service

By Lem Adams
General Supervisor Maintenance of Way, Union Pacific, Omaha, Neb.

THE roadway machine for which we can find daily use during the entire year is the ideal for which we strive.

But what of the so-called seasonal machine? It must be rated upon a different basis, or other work developed for it by means of special attachments. The weed burner and weed mower, with their effective power plants, could well be fitted with ballast

A Process That Is Rapidly Becoming Obsolete

discers, or ballast shapers, and employed economically for opening up shoulder drainage in the spring, and dressing up in the late fall.

The rail crane, when not in service on its regular assignment of laying or picking up rail, or other hoisting operations, can be put to similar uses. Then, too, the power rail crane is a very effective power plant for taking men to and from work when a train of trailers is attached, thus saving one or more motor cars. The rail oiler can also be assigned to some such service, when not required in its dual capacity of oiling and paint spraying.

It devolves upon us, therefore, to keep our labor-saving equipment busy in order to get the largest possible return from it and, of course, to cut our operating expenses by reducing our requirements for man power. One of the principal points we should observe, in order to attain the highest degree of success in the operation of a machine, is that it must be used wherever it can be of economical service.

This naturally requires very adequate programming, in order that all machines may be kept employed on work for which they were designed, and this should be kept in mind when considering the purchase of new machines of the same type. By spreading out the work, where it is economical to do so, over a greater period, a smaller investment in roadway machinery will be required.

It is now found that dragline outfits may work economically for two shifts in 24 hours, especially in the long daylight period of the summer months, and even by their own light in the spring and fall months. This has the effect of one machine doing the work of two, and while it will naturally wear out sooner, the investment is cut in half.

In purchasing equipment for saving labor, first consideration should be given to the ruggedness of its construction and the reserve power employed, this to insure that the machine will be "on the job" most of the time. The most costly of all operations is to have a power machine fail when a large gang of men is dependent upon it, and it greatly demoralizes the men to be thrown out of their working stride.

And what a "pace setter" some of these machines can be, when put to work in a large gang! The rail crane and ballast tamper are good examples. They crowd the gang ahead and make those following hustle to keep up with the back work. Keep the machine moving and the men must be on the alert.

Those who operate railroads wholly within the cold climates sometimes have difficulty in finding work for roadway machines when the ground is frozen. Therefore, they must figure the effective saving period on the shorter, or two-thirds, year and use the idle time for making repairs and getting all equipment into condition for another working period.

Since each year seems to add some new burden of expense to the railway, it is constantly necessary to find a means of offsetting this expense by performing maintenance work more economically. Despite the tendency toward increased speed of trains and increased weight of rolling stock, the most compelling reason for the use of labor-saving equipment is a reduced maintenance allowance.

It is incumbent upon all maintenance officers to watch carefully the performance of maintenance of way equipment, and secure from it all of its latent earning power. For depreciation and interest on the investment accrue the same, whether the machine is idle or at work, but the machine pays dividends only when working.

Breaking Down Resistance To Use, Is a Major Problem

By F. R. Layng
Assistant Chief Engineer, Bessemer & Lake Erie, Greenville, Pa.

IT IS my observation that we are resting somewhat on our oars in connection with the further development of labor saving machinery. A few machines have been developed that have been a great help in maintenance work, and their use is fairly general, but I believe that most railroad men are fairly well satisfied with the progress already made, and are not diligently and intensively trying to develop additional labor saving devices.

In connection with the use of labor saving devices there is the necessity of breaking down the inertia of foremen and supervisors to the intensive and constant use of the machinery. Too often a machine is shipped to the job and instructions issued to use it and no real effort is made to assist the foreman and men in understanding the use of the device or how to do the work it is intended to do. Often it is set to one side and not used because it seems easier to do the work the old way. The work of educating these groups has not been completed and greater efforts along this line at this time are necessary.

On many roads, these two problems, the need for some enthusiasm and interest to develop new devices and the will to use those already developed, are the outstanding problems to be met with at present. This indifference and resistance can be broken down only by the responsible officer in charge of maintenance on each property, seeing to it that his subordinates are convinced that the device is economical and proper for the work to be done.

Another problem in connection with labor saving

equipment that has not been very generally worked out, has been to keep the equipment profitably employed a sufficient number of days each year to justify the interest in the investment. Too often this part of the problem has been neglected, because the responsible officers believe that the only thing necessary is to get the equipment on the road and that it will then take care of itself. There is abundant evidence that this is far from the case, and one of the first steps to be taken is to schedule the use of each machine properly, so that it will be used productively as much of the time as possible.

In order to accomplish this, it is apparent that, so far as possible, machines should be so designed that they are capable of doing more than one class of work, so that when any such machine is not busy performing a certain kind of work it can be used for some other purpose.

Another item in connection with labor saving equipment, which should receive attention, is the development of devices that get away from steam power so that the difficulties of coal, water, watchmen, etc., are eliminated and standby losses are cut down to a minimum. It is believed to be a fair statement that the continued use of steam in many labor saving devices is a mistake and that we should encourage the development of gasoline and Diesel engines to a much greater extent than has been done in the past.

Several Questions Must Be Given Detailed Study

By M. M. Backus
Assistant Engineer Maintenance of Way,
Illinois Central, Chicago

IN ORDER to secure the maximum return from the money expended for labor saving equipment, several important phases of the subject must be given detailed study and attention. These include:

The selection of the right kind of equipment.

A program which will keep the equipment busy after purchase.

Adequate provision to keep the equipment in repair.

Operators definitely trained in order to be efficient in the use of the equipment.

The last three items require rather extended comment. It is said that the equipment must be kept busy. If proper judgment has been exercised in the purchase of the equipment, the maintenance officer who is responsible for its use will not be faced with a periodic hunt for work for it to do, but should be able to keep scheduled in advance a sufficient amount of work which has to be done, and which, otherwise, would be done by more expensive hand methods. He should keep in mind the idea which is expressed by the words "labor saving equipment." Keeping a device busy on tasks which are not necessary, and which give no results in the way of decreased expenses is not getting the maximum benefit out of labor saving equipment.

It is said that the equipment must be kept in repair. That is, it must be in condition to be used when the need presents itself. There are many seasonal tasks, such as the removal of snow and weeds, surfacing track, etc. Repairs should be made to labor saving equipment for such work during the idle season and these should be made so thoroughly that the machines will go through the busy season with a minimum of running repairs, it being understood, of course, that all repair work should be accomplished as economically as possible.

Operators must be so trained that maximum service will be received from the machines while in use This implies a familiarity with the construction of the machines and a knowledge of how to make minor repairs, as well as the ability to run the machines to full capacity without unnecessary wear and tear.

Many articles have been written and much discussion centered around these important items, and there has resulted a noticeable improvement in the conditions under which roadway machines are used as compared with a few years ago.

The first subject has a distinct bearing on the other three. A great deal of thought, therefore, should be given to selecting the equipment. The procuring of labor saving devices goes through several stages. At first there is the urge to secure labor saving equipment. A desire to make a showing by reduced expenses, to overcome a shortage of labor, or to accomplish tasks which cannot be done by hand, furnish some of the reasons for purchase. The men in the field, in contact with and directly responsible for the upkeep of the property, frequently learn of labor saving devices through neighboring divisions or railroads, through advertisements in the trade journals or through information given them by general officers, and make requests that they be provided with such machines.

On many roads, an opportunity is given every year to division officers to request labor saving devices, and a budget is made with the division requests as a basis. The division officer, before ordering a machine which, if justified, is very liable to be given him, should have in mind what kinds of machines will bring the best returns in money, and these should be listed in order of preference. Enough is now known about the performance of most machines, so that it is not difficult to decide whether a particular machine can save enough in its term of life to justify its purchase, giving due consideration to interest on investment, depreciation, repairs and cost of operation. The division officer should decide, then, whether he will get the largest return from tamping machines, discing machines, weed burners, rail laying machines, earth moving machines, or machines of other types, and list them accordingly. He should also, so far as possible, give catalog references, prices and full details as to the work to be done, and should include a detailed description of the device wanted. Where electric tools are requested, full information should be given as to the current available.

The general officer, in making up a budget, must keep the same ideas in mind and be sufficiently acquainted with labor saving devices to detect inconsistencies and eliminate machines that are not properly justified.

After the list of items worth while has finally been submitted to the management, and the arguments in favor of purchases have been shown to be based on facts and the purchase has been approved, selection becomes the most important step in the entire transaction. If the equipment is to be properly selected, the following considerations must be taken into account:

1. Adaptability. A machine should be purchased which can best product the results desired. If it is for surfacing track, a device is wanted that will leave the track in the best riding condition; which will put it in shape to stand up under traffic; and which will

do the most work per day, with the least number of men and with the smallest amount of fuel and supplies. This requires also that the men using the machine must like to use it, so that weights and shapes all have their influence.

2. The device must be dependable. The return which may be expected from a device is affected directly by its life expectancy. A machine made of inferior materials, carelessly put together, or with the vital parts unnecessarily inaccessible, invariably results in expensive annual repair costs, and one has a machine liable to break down at critical periods, when such breakdown may mean the loss of days to a high priced and efficiently built up organization. Reliability is of such importance, that machines should be selected which have passed the experimental stage, and have a known background of long and dependable service life.

It is realized that, to further progress, the railroads must co-operate with the manufacturers in trying out new devices, but this should be done sparingly and only to such extent as is necessary to demonstrate what cannot be determined by other means, such as factory service tests and laboratory tests. There have been instances where high priced equipment has been purchased, which has given a large amount of trouble as a result of breakage at frequent intervals through the working season.

Simplicity in construction is desirable. This feature makes it much easier to secure competent operators, tends to keep down the cost of repairs, insures greater reliability and, indirectly, increases the life of the machine.

After all of these items have been given full consideration, the price should then be taken into account and, where all other conditions are equal or where the aggregate of the advantages which have been mentioned, is equal, the price should become a governing factor, but not before. Nor should outside influence be permitted to enter into the purchase, without giving proper consideration to the essentials.

Dependable Maintenance Is Primary Requisite

By J. R. Watt
General Roadmaster, Louisville & Nashville, Louisville, Ky.

THE effective use of labor saving equipment depends, in my opinion, primarily upon two fundamental requirements: (1) The machines must be maintained so as to be at all times in good operating condition; and (2) a carefully laid out program for using the equipment is necessary. But a program cannot be carried out successfully unless the equipment can be depended upon to function in the manner contemplated when the program is in process of preparation. This indicates how intimately many of the phases of the labor saving problem are interwoven; another indication is found when we consider the question of operating and maintaining the equipment.

The first consideration, in order to assure satisfactory maintenance, is the selection of dependable machines, and the next in order of importance is the selection and proper training of the men who are to operate them. These statements are made, having in mind such widely different equipment as steam ditchers, gasoline rail-laying cranes, locomotive cranes, motor cars, air compressors with their incidental equipment of air lines and tools, and practically all other maintenance of way machines. It is my opinion, however, that the most important problem facing the railways in the use of labor saving equipment is that of keeping the machines in good operating condition.

Another matter which must be taken into account and this is also interwoven with the problem of maintaining the machines, is the reluctance of many of the men in the roadway department to use the equipment which has been provided for their use. It cannot be denied that, in order to effect the reductions in cost which are demanded, labor saving equipment is essential. But, there are still many who prefer to avoid the use of these machines, because of the amount of attention and maintenance which they require.

This prejudice can usually be traced to failure of the equipment to function. Such failures are always expensive and result in disorganization of the forces to which they are assigned. Work requiring gangs of men is planned, taking into account the character and capacity of the machines to be used. If the equipment fails in service, the plans must be changed and the work carried on at a disadvantage. This explains much of the tendency to depend on simpler but less efficient methods, with which I must confess considerable sympathy, provided it is necessary to depend on equipment which is in a poor state of maintenance.

A gang which assembles at a tool house, expecting to use a motor car which will not start, would be better off with a hand car. The failure may be caused by some simple and easily remedied defect, but the men using the car usually have little mechanical training, so that much time is wasted that could have been saved by proper attention to maintenance.

I doubt whether there are any supervisory officers who would not gladly plan their work with a view to using as much machine equipment as practicable, if confidence in its dependability is once established. I fully believe that machine equipment, which is so essential to the efficient and economical handling of maintenance of way work, will have a wider application and that its use will be approved by the man on the ground when he can be assured that it will operate as intended.

The importance of selecting dependable equipment has been emphasized. Unfortunately, there are many machines on the market which are not designed primarily with a view to good and dependable service, but rather for the purpose of underselling some competitor. The purchase of such equipment does not result in economy, but will, in a short time, lead to some of the failures which have been mentioned. The statements of high-powered salesmen, who are necessary in order to sell such equipment, should be analyzed carefully.

It should be realized also, that, no matter how well designed and built, any machine will require maintenance, the amount depending on the character of the service in which it is engaged and the care with which it is operated. For these reasons, adequate provision for this maintenance is essential, as well as for supervising the operation. If this is done, the results will invariably justify the effort. A single organization can do both, and can demonstrate about equal savings by following the practice of a "stitch in time" and by educational work among the machine operators.

Keeping Pace With Pr
In B

Pneumatic Jack Hammers Save Many Hours Labor

New Haven organization adheres to a well-defined policy and finds modern devices indispensable in meeting current demands

THE OLD time bridge and building foreman was quite content with his simple outfit of tools and equipment. Yet, there have been few who have been more ready to avail themselves of modern aids than the bridge and building forces.

The development of labor-saving equipment in the bridge and building department may be pictured most adequately by a study of the development as it has taken place on any one of a number of roads, but possibly no more impressively than on the New York, New Haven & Hartford, a road with 2,097 miles of line, where the old order of things has completely changed, in spite of such effort as may have been made in the past to be as modern as the times would permit. Only a relatively few years ago the bridge and building department of this road, like that of other roads, was an organization in which manual skill and physical labor were the paramount factors in handling even the heaviest tasks. While both of these factors are still essential in bridge and building work, modern equipment has made it possible to do this same kind of work with less physical effort, greater skill, and with much more speed and economy.

Employ Modern Machines

Such early equipment as was used on the New Haven has almost disappeared by replacement with modern machines, tools and devices. The few old stiff-leg derricks that were formerly in use have given way to a full equipment of locomotive cranes, equipped in some cases with buckets, magnets and pile-driver leads; the old drop-hammer rig has been replaced by faster and more efficient self-propelled pile-driver units equipped with steam hammers; a few old steam air compressors have been supplemented by numerous gasoline-driven engine compressors; the concrete mixer has undergone numerous improvements and has come into more extensive use; pneumatic tools, such as drills, jack hammers, riveting guns, concrete busters, etc., and electric drills and augers are common equipment; power saws and woodworking machinery have relieved the hand saw to a large extent; steel cutting work is now effected almost entirely with acetylene torches; the paint spray has largely replaced the brush; and the use of motor trucks has not only speeded up many operations but has been effective also in reducing work train expense. With a full realization of the economies possible through the proper application of modern labor-saving equipment, this development is still going on. For example, the New Haven is now adding 12 new gasoline engine-driven portable air compressors to its present equipment of 29 units, and is also replacing 6 gasoline engine-driven tie-dapping machines with 5 new electric-driven dappers.

Some of the more important units of work equip-

The Power Hand Saw Has Proved a Labor Saver Both in the Shop and in the Field

Progress B. & B. Equipment

Power drills are also used effectively by the bridge and building department

ment made available to the bridge and building forces of the New Haven include 43 locomotive cranes, ranging in capacity from 3 to 30 tons, 2 of which are equipped with pile-driver leads for steam hammers; 4 self-propelled track pile drivers equipped with steam hammers; 6 derrick cars; 22 gasoline engine-driven and 1 steam-driven concrete mixers; 6 gasoline engine-driven tie dappers, which are now being replaced by 5 electric dappers in a newly constructed dapping plant; 14 paint-spray outfits; a universal woodworking machine at the bridge and building shop on each of the 9 divisions of the road; a portable gas engine-driven table saw for use in the field at larger jobs; 29 air-compressor units, ranging in capacity from 88 cu. ft. of free air per minute to 300 cu. ft. of free air per minute; a full complement of pneumatic tools, such as riveters, jack hammers, concrete breakers, etc.; a sand-blast outfit; 12 motor trucks of from 1½ to 3 tons capacity; 2 two-man electric power saws and a number of one-man power saws; acetylene cutting outfits for each division; plumbers tools, such as vises, pipe cutters and threaders; a number of portable diaphragm pumps; a wheeled tractor equipped with a rotary brush for sweeping snow from the platforms and walkways about the station at New Haven and for cleaning up about the freight house facilities at that point, and a caterpillar tractor equipped with a plow for removing snow from the drives and roadways about the passenger and freight facilities at New Haven.

In addition to the equipment mentioned, and a number of smaller tools and devices not included in the above, the New Haven has recently developed an automatically operated device, mounted on a track velocipede, for painting the safety zone lines on station platforms. It has also secured a rotary broom attachment to supplement the work of the tractor sweeper mentioned above, which can be readily mounted on and operated in connection with any of the electric storage battery trucks used at the more important freight houses.

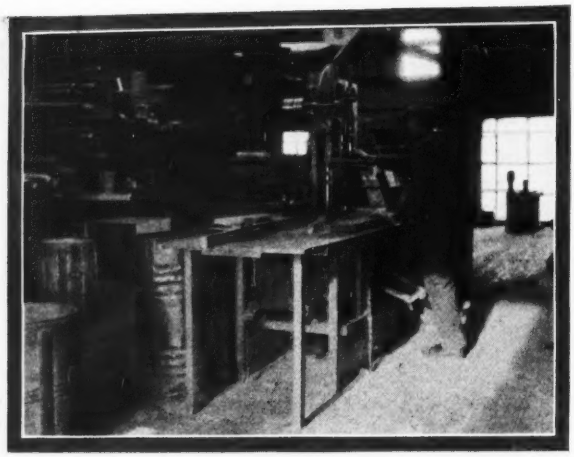
The Two-Man Power Saw Is Particularly Effective in Cutting Off Large Timbers and Piling

Many Units Are Considered Indispensable

The equipment made available to the bridge and building forces has not only proved highly effective and desirable, but many of the units are now considered indispensable, not only from the standpoint of economy, but also from those of speed, safety and reduced physical exertion. Thus, modern hoisting equipment could not be dispensed with in bridge and building work without the most serious results. No bridge and building supervisor or foreman would give up his air and electric driven tools, nor could he conceive of being without a concrete mixer. The paint spray has come to stay, and while its introduction required the education and training of certain forces, the New Haven considers it highly efficient and economical for many classes of painting work.

The same might be said with regard to numerous other types of equipment which have been properly developed and properly introduced into the work of the bridge and building forces. One of the most effective additions to the equipment of these forces on the New Haven in recent years has been the motor truck. Today, this equipment is considered essential to the expeditious handling of men, machinery, tools and parts to and from work. This is due in part to the curtailment of local passenger service which has been necessary in recent years, but to a greater extent, to the recognition that the motor truck, if properly assigned, operated and maintained, is faster, better adapted, and more economical than the work train for a wide range of bridge and building work. With its modern trucks, the large item of work train expense on the New Haven, of only a few years ago, has been cut to a minimum, and, at the same time, there has been a corresponding reduction in delay to work and in interference with train operation.

As a result of its experience with labor-saving equipment, the New Haven recognizes to the fullest extent the value of such equipment in carrying out the work of the bridge and building department. At the same time, it also fully appreciates that the reali-



A Universal Woodworking Machine in One of the Division B. & B. Shops

zation of this value is predicated upon certain essential requirements, not only with respect to the operation of the equipment, but as regards the purchase and maintenance of the equipment as well. All of these factors are reflected in the policies and practices of this road with respect to its labor-saving equipment.

In the first place, it feels that it is just as uneconomical to have too much labor-saving equipment as to be inadequately equipped, and that it might easily be just as expensive to operate ill-adapted units of labor-saving equipment as to use the old-time methods which the equipment was designed to improve upon. In view of this, each unit of equipment on the New Haven is purchased only after a careful determination of the need for it, and a careful analysis of the unit itself in order to be assured that the equipment meets the need in the most practical manner. Requests for equipment originating on the divisions must be accompanied by written statements of the need for the equipment and of the economies to be effected, and all requisitions for equipment are handled through a supervisor of work equipment who is in a position to check the need and to pass upon the merits of the equipment requested.

Clearing through one office, where a record is kept

Pneumatic Bridge Tools Speed Many Bridge Jobs

of all equipment on the system, there is little probability of the road becoming overloaded with certain types of units and, at the same time, there is assurance that equipment best adapted to the needs will be secured if these needs actually exist. Thus, for example, instead of purchasing 12 motor trucks of the same type and capacity to meet the various service requirements of the bridge and building department, each of the trucks was purchased with a specific class of service and need in mind. As a result, the bridge and building department has three 2-ton trucks with standard truck bodies; three 2-ton truck with power dump bodies; and six other trucks with canopy tops, which include one of 1½ tons capacity, two of 1¾ tons capacity, one of 2 tons capacity, one of 2½ tons capacity and one of 3 tons capacity. With such a range of types and capacities, there is a truck for every requirement of the bridge and building forces, specially designed to fill these requirements in the most effective manner and with the greatest economy.

Equipment Is Intensively Operated

Having purchased the type and quantity of equipment or devices needed, strictest care is exercised to see that it is used to the fullest extent, that it is effectively operated and as carefully maintained. All of these responsibilities come under the jurisdiction of the supervisor of work equipment, except in so far as they pertain to the smaller units of equipment and special devices assigned definitely to the various divi-

Power Drills Are Also Used Effectively by the B. & B. Department

sions. Co-operating with bridge and building supervisors and their division engineers, the supervisor of work equipment assists in the making of work programs so that any equipment which may be needed can be made available when needed, and yet be kept busy continually on the work of the various divisions.

Equipment Is Pooled

In reality, very little of the larger equipment used by bridge and building forces is assigned definitely to a single supervisor or division, and certain of the equipment is not even for the sole use of the bridge and building department, Thus, for example, any of the 43 locomotive cranes mentioned previously can also be used by the mechanical, stores and track departments; the air compressors are the tie-tamping units used by the track department; and the motor

trucks, while assigned to the bridge and building forces, are available for use by any of the other departments in case they have need for them. In this way, the equipment is kept busy a maximum amount of time, making justifiable, in certain cases, expensive equipment which could hardly be justified for the limited use of the bridge and building department or any other department alone.

The selection, training and assigning of operators for the larger units of equipment, such as cranes, pile drivers, etc., also come under the direction of the supervisor of work equipment, as do the road maintenance and repair of all equipment except the smaller tools and devices. These latter factors with

Many Uses Are Found for This 2½-Ton Truck by the B. & B. Forces

regard to labor-saving equipment on the New Haven are given the most careful attention and, as a result, it can be said that there are few roads which are as well organized to insure that all of their equipment is kept in thoroughly effective operation and in constant repair.

The Repair Organization

Routine maintenance and light field repair of the equipment are left to the operators or gang foremen, who are held definitely responsible for its operation and care. In addition, however, the New Haven has an independent work equipment repair organization, directed by the supervisor of work equipment, which includes inspectors, motor-car and gas-engine mechanics and an electric-vehicle mechanic. This force of men is kept almost constantly on the road, inspecting equipment, assisting in making running repairs, and in keeping the supervisor of work equipment informed of the condition of the various units. The men in this force also recommend such heavy repairs as they may deem necessary and make arrangements, through the supervisor of work equipment, for shopping the equipment when this is required. A detailed description of the equipment maintenance organization of the New Haven, together with a description of the methods employed on that road with respect to all of its labor-saving equipment, was included in the March, 1927, issue of *Railway Engineering and Maintenance*.

The successful functioning of the work equipment on the New Haven, which applies to that employed in the track department as well as in the bridge and building department, is predicated on the fact that every man who has anything to do with the equipment, whether it be purchasing, operation, inspection or repair, is experienced in the work to which he is assigned. The result is that this road has earned large returns on its investment in this equipment and will continue to do so in the future.

Test Ties Now in Twenty-First Year

AFTER 20 years of service, 13,755 experimental treated ties, or 64 per cent of a total of 21,605 originally laid in test tracks on the Chicago, Burlington & Quincy, have been removed for all causes, approximately 26 per cent of the total having been removed because of decay. The other 38 per cent failed from such causes as rail or tie-plate cutting, splits, checks, shakes or breaks and from derailments and dragging equipment. Of a total of 3,270 untreated ties laid at the same time, only 13 remain in service.

These facts are revealed in a summary of the twentieth annual report, as of January 1, 1930, covering data in regard to experimental ties laid in test tracks on the Burlington in 1909-10. These ties are of 20 different species of wood, treated by various processes, while approximately 15 per cent were untreated. In order to ascertain the full effects of different climatic conditions, the ties were laid on 20 divisions in eight states. The usual procedure was to place about one thousand ties at each location. For proper identification, each tie was marked with a dating nail showing the kind of wood and the treatment used. A careful record is kept, giving the cause of removal of every tie as well as the kind of wood and the treatment used.

Three processes were used in treating the ties: The coal-tar creosote method, with the full-cell process, using 10 lb. to 12 lb. per cu. ft. of preservative; the Burnett process with an absorption of ½ lb. per cu. ft. of zinc chloride, and the Card process with an absorption of ½ lb. per cu. ft. of zinc chloride and 3 lb. per cu. ft. of coal-tar creosote.

The Burlington is divided into two major districts, designated as Lines East and Lines West of the Missouri river. The results of the annual inspection are grouped under each major district, allowing the effects of the different climatic conditions on the various woods and methods of treatment to be detected. The difference in climate is largely reflected in the amount of rainfall, which ranges from 35 to 40 in. annually in the southern part of the territory east of the Missouri river to 15 in. in northwestern Nebraska.

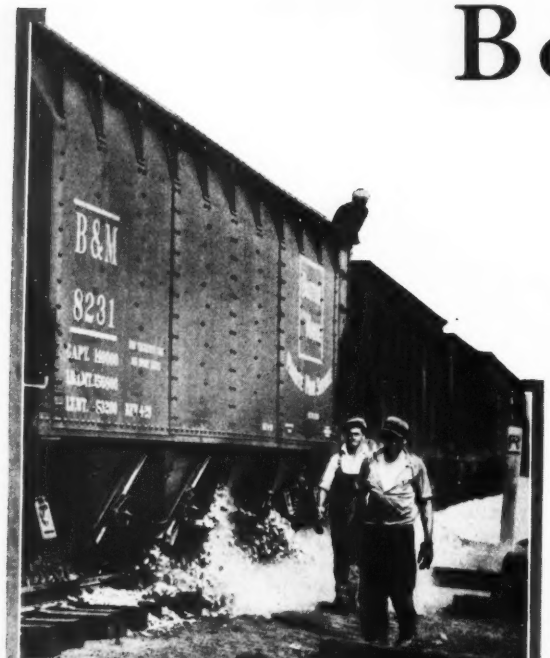
The behavior of the treated ties, classified as to methods of treatment, is shown in the following table:

	Lines East				Lines West			
Process	Total placed	Total removed to date	Per cent removed account decay	Per cent removed account other causes	Total placed	Total removed to date	Per cent removed account decay	Per cent removed account other causes
Creosote	2,045	669	12	21	1,236	551	12	32
Card	10,244	6,332	24	38	5,593	4,089	27	46
Burnett	1,578	1,269	50	31	909	845	43	49
Untreated	2,045	2,036	90	9	1,225	1,221	90	9

With few exceptions the untreated ties were removed in from 3 to 10 years, with decay almost the sole cause of removal.

Boston & Maine 3,000 Ft.

Use of additional labor-saving devices in 240-mile program results in greater speed and reduced costs



Distributing the Stone Ballast

BY IMPROVING its methods and the equipment used, the Boston & Maine has steadily increased the amount of ballasting done per man per day and reduced its cost. This is the outstanding feature of the extensive ballasting program which this road has been carrying out during the last few years in order to keep pace with the heavier locomotives which it has put in service. The performance of 1928, in which about 115 miles of track was ballasted, was considered a record that would be hard to surpass. During that year, as pointed out in an article which appeared in the November, 1928, issue of *Railway Engineering and Maintenance*, each of two ballasting gangs kept pace with a program requiring the completion of 2,000 ft. of track each day. This year the two principal ballasting gangs, slightly increased in size, frequently exceeded a program calling for 3,000 ft. of completed track each day per crew, and each completed as much as 23,000 ft. of track a week.

The ballasting work on the Boston & Maine is a part of the $100,000,000 program of improvements on that road, which has already produced what is virtually a new railway. This program included a fleet of freight locomotives, which, with their tenders, each of 18,000 gal. capacity, constitute the largest freight motive power units in use in New England.

Use Crushed Stone and Washed Gravel

Approximately 200 miles of the ballasting work on the Boston & Maine last year, which includes altogether about 240 miles of track, was carried out on the Fitchburg division, the road's main line to the West via Mechanicville, N. Y. As was the case during 1926, 1927 and 1928, crushed stone and washed gravel were used, the selection being based on the availability of the material in the locality of the ballasting work. On this basis, washed gravel was used on the western end of the division, and crushed stone on the eastern end. The work was carried out by two distinct ballasting organizations, one at each end of the division, but inasmuch as these organizations were more or less similar in character, the following comments are based largely upon the work of the force operating at the eastern end of the division.

As was the case last year, the unusual efficiency displayed in this year's work on the Boston & Maine is attributed to four major factors; a carefully planned program, the effective arrangement and use of mechanical equipment, adequate supervision over the men employed in each operation of the work, and carefully prepared and maintained records of the amount of work done and the costs incurred. As three of these factors were substantially the same as last year, it is felt that the increased performance of this year was due in large measure to one of these factors alone, that is, to the use of two new types of labor-saving equipment, the power track jack and the power track ballaster, which supplanted a large force of men with bars and picks in making the preliminary raise of the track.

The former of these, the power jack, which is manufactured by the Nordberg Company, consists of a small steel-frame track car, equipped with four rail clamps and with two power-driven screw jacks, one on each side. The jacks, each of which is fitted with a broad shoe at its lower end for support on the ballast, can be raised and lowered separately or together. Power is supplied by a 12-hp. twin-cylinder, air-cooled engine and is applied to the jacks through twin-disc clutches controlled by levers above the car platform. As used in the Boston & Maine work, this machine is operated by one man, who pushes it to the points of raise. When the operator mounts the car he steps on a platform, which automatically sets the brakes, and he then operates a lever which sets all four rail clamps on the rails simultaneously. By two jack-control levers he lowers the jack shoes to the ballast and proceeds to raise the track to the elevation desired, being guided by elevation stakes and a man with a level-board.

The Power Ballasters

The power ballasters, three of which were used at the east end of the Fitchburg division, were the Jackson power ballasters of the Maintenance Equipment Company, equipped especially for tamping stone ballast. These machines, which are mounted on steel

Ballasts of Track a Day

car bodies, consist essentially of a power unit and five heavy steel tamping shoe units attached to the lower part of a heavy cross-head extending across the track, which is raised and lowered under power in the tamping operation. Three of the tamping units were located between the rails, and one outside the rail on each side.

As in models of this machine for use in gravel ballast, the tamping units consist of two shoes, placed back to back and curved away from each other slightly, but unlike the solid blade shoes used in gravel, each of the shoes used on the B. & M. machines for tamping crushed stone consists of four independent teeth. Thus each tamping unit has eight teeth, four facing forward and four facing to the rear. All of the teeth of the tamping shoes are tipped with Stellite to afford greater resistance to wear. With this type of shoe, much more satisfactory tamping of the stone has been secured than with the wide blade shoes.

The power ballaster is controlled by one man and, when tamping, the shoes are spotted directly over the stone cribs between adjacent ties. The operation consists merely of raising and dropping repeatedly the cross-head carrying the tamping shoes. As the cross-head is raised, the teeth of the shoes hang vertically, but when it descends they spread apart on striking the ballast and thereby force the ballast sidewise under the adjacent ties.

Other Contributing Factors

Other factors which contributed much to the improved ballasting performance this year were the fact that the section of track ballasted was single-tracked during the working hours of the day to secure the maximum output from the labor-saving equipment used, and the further fact that a trainmaster was assigned definitely to the work in order to insure the most expeditious and skillful handling of work trains. This latter practice, which is relatively new, more than justified itself in the ballasting operations, and at the same time kept the regular service of the Boston & Maine on normal schedules.

Throughout the work, the trainmaster, reporting to the engineer maintenance of way, was constantly with the ballasting forces in the field and moved back and forth between the major points of operation, directing the movements of work trains. With an average of ten such trains constantly in operation delivering stone and moving equipment about, much greater performance and much more flexible operation was gained through the field trainmaster than could possibly be attained through the control of the work trains alone from the despatcher's office.

Outline of Methods Used

In carrying out the ballasting work on the Boston & Maine, the entire track structure is overhauled, this including the widening and strengthening of embankments, the improving of alinement and grade, the relining of the tracks to 13-ft. centers, the cleaning of ditches, and the renewal of all ties with less

Above — dressing up the fully ballasted track

At left—one of the 12-tool air gangs giving final surface to the track

than three years' additional life. With the exception of tie renewals and the widening of track centers, practically all of the work supplementing the ballasting was carried out by separate organizations, working far in advance of the ballasting crew. The advance organization at the east end of the division consisted of two crews, each comprising about 125 men, equipped with a ditcher and two work trains. Ordinarily, these crews worked under traffic and about a month in advance of the ballasting force, in order to avoid any chance of interference.

Contrary to the practice used heretofore, the ballasting organization was given the entire use of the track during the working day, this plan being adopted this year because of the additional heavy working equipment employed, and the belief that it would permit much more effective work on the part of the ballasting forces. Ordinarily, the road was single-tracked over sections of about four miles in length, using existing crossovers where possible, but installing temporary crossovers where this was necessary.

Ballast Standards

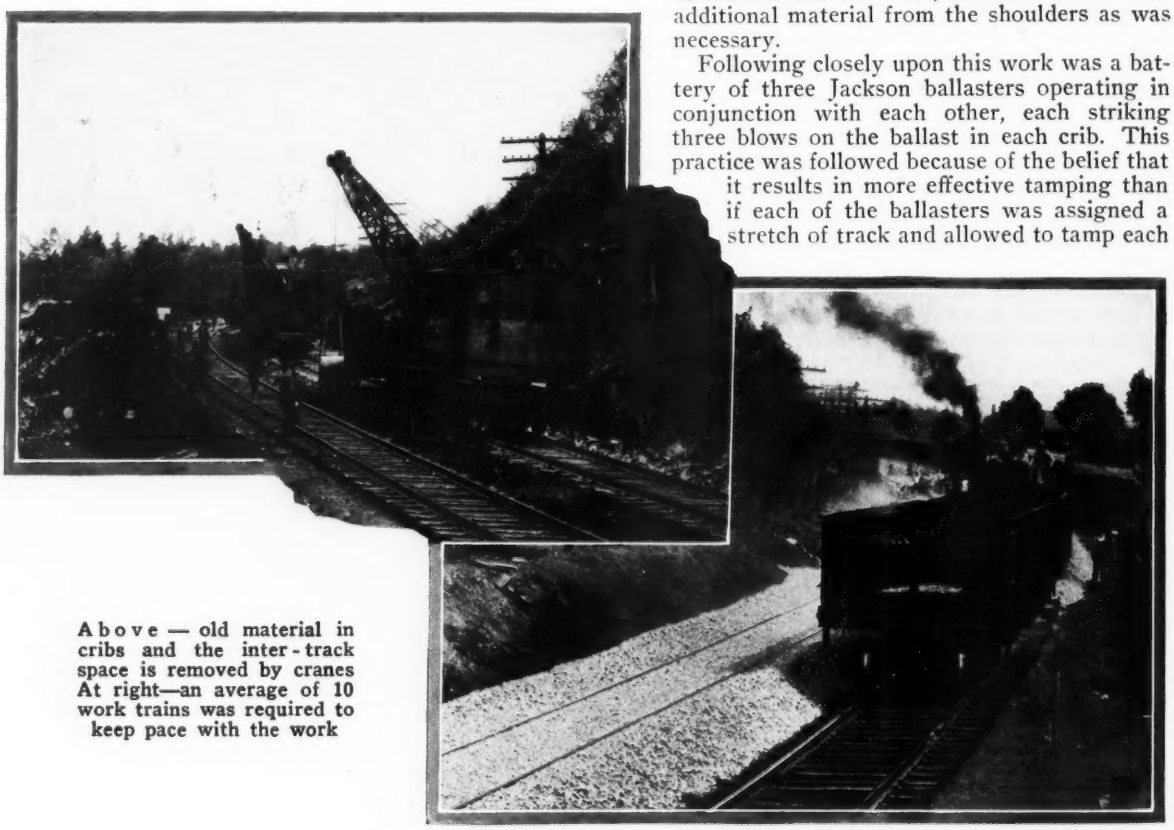
The ballast used was in accordance with A.R.E.A. specifications, and the ballast section provided a depth of at least 8 in. of stone beneath the ties, and a shoulder of 4 in. beyond the ends of the ties, from which point the ballast was sloped on a 2 to 1 slope to the toe line. In carrying out the ballasting work, each operation was well defined and each group of men formed a definite part of a carefully planned organization. The first operation consisted of cleaning out the dirt in the inter-track space to provide space for the old material from the tie crib. This was done by two Link-Belt gasoline cranes equipped with ditcher arms and special one-half yard buckets narrow enough to work efficiently between the tracks. These cranes ran on their own power and, when not employed in cleaning out the inter-track space, were used about the work in shifting cars and in picking up any excess stone which was unloaded.

The Skeletonizing Crew

Following the ditchers came a skeletonizing crew of about 70 men, which removed the material from the cribs to the base of the ties. In this work the old roadbed was not disturbed, except at bridges and at certain highway crossings where the original grade must be maintained, and where it was necessary, therefore, to dig out the old roadbed in order to place new ballast under the ties. Following the cribbing work, a gang of about 80 men renewed and respaced ties, and regaged the track. In this work all ties with less than three years' additional service life, and all softwood ties, were removed and replaced with creosoted hardwood ties. Following this gang was a small lining crew which lined the track roughly to 13-ft. centers, and then another small crew which did such final straightening of ties and spiking as was necessary.

After the subgrade was leveled up by a force of about six men, the new stone, which was delivered in 70-ton hopper-bottom cars operated in work trains, was released from the bottom doors and spread over the track by two ties placed against the rear truck wheels of each car. Raising of the track followed a day or two after the placing of the ballast, and was done entirely with the Nordberg power jack, which made lifts at both the joints and centers of the 39-ft. rail. As each raise was made, two ties at each point of lift were bar-tamped solidly, and as the jack moved forward, a gang scraped the loose stone from the tops of the ties into the cribs, and shoveled in such additional material from the shoulders as was necessary.

Following closely upon this work was a battery of three Jackson ballasters operating in conjunction with each other, each striking three blows on the ballast in each crib. This practice was followed because of the belief that it results in more effective tamping than if each of the ballasters was assigned a stretch of track and allowed to tamp each



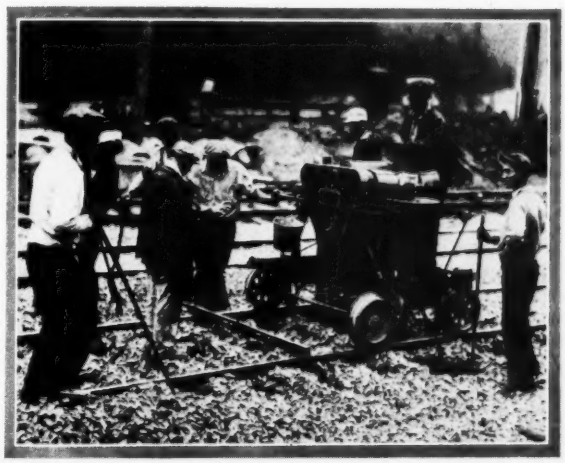
Above — old material in cribs and the inter-track space is removed by cranes At right—an average of 10 work trains was required to keep pace with the work

tie fully at one setting. It also has the desirable feature of keeping the ballasters together where the work can be closely supervised by one man.

No further work followed the rough tamping until about a week later when the track was given a final surface by a gang of about 70 men equipped with five Ingersoll-Rand 12-tool pneumatic tie tampers. However, within this interval, the track was opened to traffic under a speed restriction of 35 miles per hour in order to secure the benefit of traffic tamping.

Tamping Methods Were Repeated

The method used in the air tamping was similar to that used in 1928, in which each of the 12-tool tampers was equipped with 1,000 ft. of 1½-in. black steel pipe, made up of fifty 20-ft. lengths. In each air line, the 20-ft. lengths were joined together in groups of three by means of standard pipe couplings, and the successive three-length sections were joined by short lengths of standard 1¼-in. air-brake hose fitted with standard air-brake connections. In addition, each of the three-length sections of the main pipe line was fitted with a right-angle take-off, provided with an air cock and a short section of air-brake hose with a coupler head for tapping the air line. With these taps at intervals of about 60 ft., the difficulty of dragging long sections of air hose with the tamping units was entirely eliminated.



The Nordberg Power Jack Making a Preliminary Raise

A Progressive Advance

In carrying out the work, the air compressors were set off along the track at intervals of about 2,000 ft., and, initially, in advance of the 1,000-ft. lines which they supplied with air. The tamping crews worked forward from the far ends of these lines and, as the work progressed, and the far ends of the lines were left out of service, they were broken at the hose couplings and the lengths so released were pulled forward and connected to form continuous lines for 1,000 ft. in advance of the compressors. Only three or four of the five compressors were actually in service at one time inasmuch as certain of them were constantly being moved ahead and set up for operation as the work progressed.

Following the air tamping gang closely was a small force giving a final line to the track, and then a larger force of about 60 men dressing up the ballast section and establishing a toe line. Excluding the grade revision gang working in advance of the ballasting forces, and the gang renewing ties, the entire ballasting organization operating on the east end of the Fitchburg division included about 250 laborers, 3 general foremen, 12 foremen and 8 assistant foremen, this force remaining practically constant.

Improvement in Results and Economy

That improvement in the conduct of the work was made this year is seen through the fact that a scheduled program of 3,000 ft. a day was maintained throughout the work with little difficulty, whereas a program of 2,000 ft. a day was the best record that could be maintained with the organization which carried out the ballasting work during 1928. The following table shows a comparison of the average output per laborer per day in 1927 and 1928, with the record established up to October of this year.

	Single Track		
Operation	1927	1928	1929
Cribbing	39 ft.	43 ft.	42 ft.
Distributing	275 ft.	322 ft.	329 ft.
Raising	48 ft.	52 ft.	61 ft.
Tamping and Surfacing	36 ft.	38 ft.	38 ft.
Trimming	67 ft.	75 ft.	*45 ft.

*Includes dressing of subshoulders and other finishing work not previously assigned.

The improved economy with which the ballasting work was done in 1929 as compared with 1926, when ballasting work on a large scale was first undertaken, is not only indicated by the increased output per man-hour, but also by an examination of the costs of carrying out the different phases of the work.

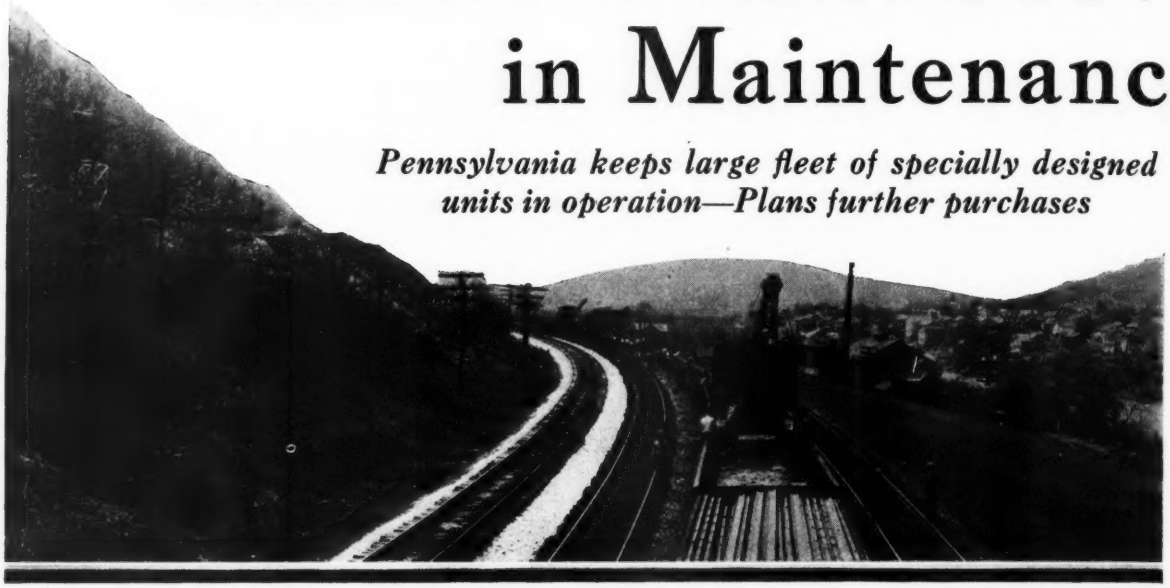
Three Power Ballasters Were Used on the Work

A comparison of the costs of the work in 1929 with the costs of the work done in 1926 shows reductions of 7.5 cents per foot for cribbing; 3.9 cents per foot for labor, work train and equipment costs; and 6.8 cents per foot in the cost of raising track. In addition, it shows that tamping and surfacing costs have been cut 6.1 cents a foot, and that the trimming work cost 1 cent a foot less than it did in 1926.

All of the ballasting work on the Boston & Maine has been under the general direction of W. J. Backes, chief engineer, and H. F. Fifield, engineer maintenance of way. The work on the east end of the Fitchburg division has been under the general supervision of S. P. Coffin, division engineer, and under the direct supervision of H. C. Archibald, assistant division engineer, and L. V. Barrett, assistant supervisor of track.

Crawler Cranes Prove in Maintenance

Pennsylvania keeps large fleet of specially designed units in operation—Plans further purchases



Unloading Rail on the Pennsylvania with Crawler Cranes

DURING the last year the Pennsylvania has been using extensively, and with an unusual degree of success, a relatively new unit of maintenance of way equipment—the crawler-type crane. Surprising as it may seem, particularly in view of the wide-spread use that has been made of locomotive cranes and other types of hoisting equipment in maintenance work, the possibilities of a relatively small capacity crawler-type crane in the maintenance field are only now beginning to be realized. That such possibilities are now appreciated, at least by the Pennsylvania, is shown by the fact that more than 80 such cranes are now engaged in a wide variety of maintenance activities on that one road. Further evidence in this direction is the fact that this same road is now planning the purchase of a number of additional cranes of this type to speed up a largely extended ditching and general maintenance program planned for 1930.

The outstanding feature of the crawler-type cranes used on the Pennsylvania is their versatility. Fully equipped with attachments available at the present time, these cranes can be adapted for a wide variety of operations. With a drag-line, a clam-shell or a dipper bucket, they are adapted for almost any class of ditching or material handling operations; with a clam-shell bucket they are also effective in handling ballast, refuse, cinders, coal and snow; with rail tongs they can load and unload rail with the greatest of facility; with a hook they can handle frogs and be used for numerous other items of work; and with a magnet, they are effective in the handling of special trackwork, track materials and scrap. Further than this, the cranes are unusually mobile. They can be operated on flat cars or within low-side gondolas with drop ends, loading and unloading themselves without difficulty. They can be transported easily from place to place over the railroad, and they can operate readily across tracks, within ditches, and along the roughest right-of-way.

The 80 or more crawler-type machines on the Pennsylvania are being used in all of the various services mentioned and under all of the conditions named, and it is said that they are proving a valuable aid in effecting work and in reducing maintenance expenditures. There are several outstanding reasons why the crawler-type machines were adopted by the Pennsylvania for its maintenance work, and why their use has become so general on that road. In the first place, this road was confronted with an extensive program of deep ditching in its plan for improving its roadbed at many points, and it was evident that this work could not be done with its regular work equipment. Furthermore, it was evident that this extensive work could not be done effectively or economically with equipment which required the use of a track. This latter consideration, possibly more than any other, led to the use of the crawler

An Object Lesson

One of the outstanding trends in the application of labor-saving equipment to maintenance of way work is the adaptation to railway tasks of power machines that were hitherto assumed to have no place in this field. It was once generally accepted that any unit of mobile machinery for railway work must be mounted on flanged wheels. But that day passed with the adoption of crawler treads for power shovels employed in railway grading. That the crawler tread is equally applicable to excavating and lifting machines used in maintenance of way work is clearly shown in the article appearing on these pages. It should serve as an object lesson in the necessity for an unbiased attitude in considering the merits of any device that is offered as an agency for economy in maintenance work.

Versatile Work

machines, because it was known that any machine carrying out this work from a track immediately adjacent, would not only be delayed by traffic, but would interfere with train operation. This assumed special importance on the Pennsylvania because of the fact that, almost invariably, the outside tracks in its extensive four-track system are high-speed heavy-traffic passenger mains. The second most important consideration in connection with the adoption of the crawler machines was their adaptability for the deep ditching planned, working entirely clear of train operation, and furthermore, their general versatility, which would permit their effective use in a wide range of maintenance work, and thereby, their effective employment throughout the year.

Under Regional and Divisional Control

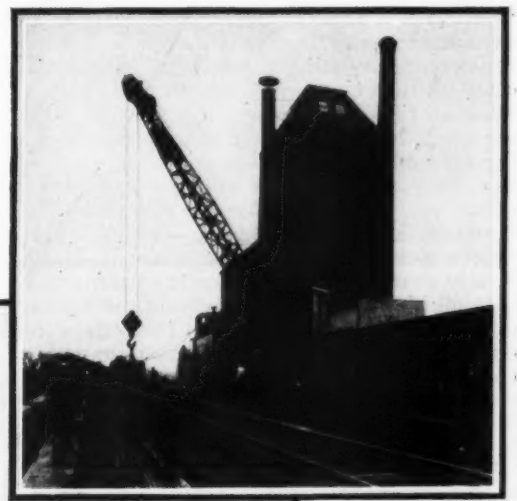
The crawler cranes on the Pennsylvania at present are divided among the three main regions and the New York zone, the various units being assigned to the different divisions where they are worked in accordance with the regional and divisional programs. The number and character of the auxiliary attachments, which have been furnished to the various divisions for use with their crawler units, has depended entirely upon the character and extent of the work to be done.

The most extensive use made of the crawler machines on the Pennsylvania up to the present time has been in cut-widening and deep ditching service. In most of this work, the drag-line bucket has been used with the crawler unit on top of the bank, entirely clear of train operation. Where this method of excavation was not particularly suited, the crawler machines, equipped with shovel booms and dippers, have been operated in the ditches, but this was avoided wherever there was any likelihood of the machines fouling adjacent tracks. In other cases, particularly where the material to be excavated was wet and sticky, the cranes were equipped with clam-shell buckets and loaded the material either directly into cars or into motor trucks employed to haul it away. Approximately ten miles of heavy ditching was done on the New York division alone with the crawler units during 1929. In this work, the ditches were cut down from four to six feet below the bottoms of the ties to insure positive drainage of the roadbed.

Cutting Back a Troublesome Side Slope with One of the Crawler Machines

The shovel attachment has also been used effectively in borrow pits for handling material, and in drainage work off the right of way. In one instance, one of the units dug itself up a steep hillside adjacent to the right-of-way, to a height of about 50 ft., and drained a pool of water which had caused a stretch of soft roadbed for a number of years. The water released from the pool was drained off through a trench dug in the hillside by the shovel as it ascended to the pool level.

Where traffic conditions permitted, the crawler units with shovel attachments have also been used on flat cars in cleaning and re-forming ditches alongside the tracks. In this service it has been the usual practice to employ them in a work train on separate



Above — a crane equipped with a magnet loading used track material

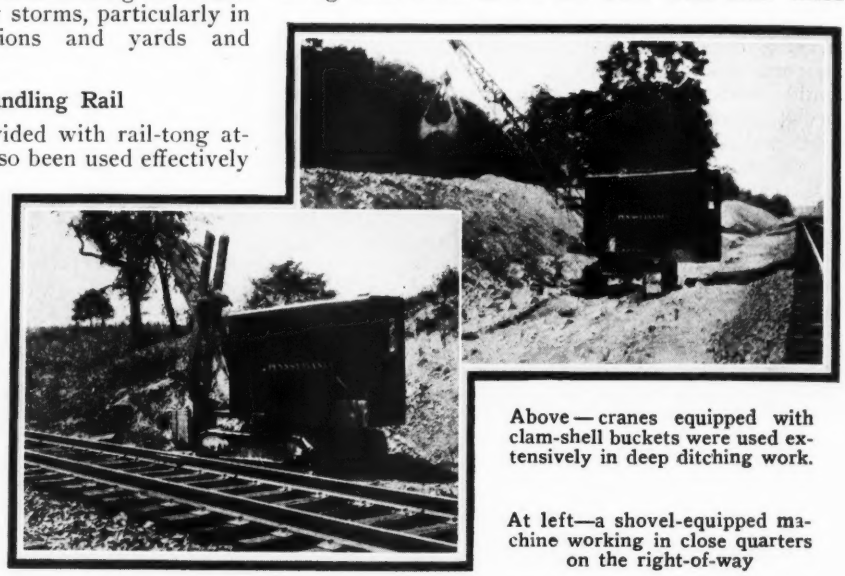
Right—one of the crawler-type cranes equipped with a drag-line attachment, widening the roadway

flat cars, with a gondola at each end of each shovel car to receive the excavated material.

When excavating with a clam-shell bucket, or using this attachment for handling ballast, cinders, coal or refuse, the cranes are usually operated on the ground, but they have been operated on flat cars with suitable material cars at each end. This latter practice has been used extensively, especially in ballast screening operations. In addition to these uses of the clam-shell attachment, it is expected that the clam-shell will prove effective in loading snow and cleaning up after heavy snow storms, particularly in and about passenger stations and yards and terminals.

Are Used for Handling Rail

Mounted on cars and provided with rail-tong attachments, the cranes have also been used effectively for loading and unloading rails, performing a service which was formerly done by special equipment adapted to that class of work alone. When extensive rail handling is to be done with a crane equipped with a clam-shell bucket, the bucket is removed from the hoisting ropes and replaced with rail tongs, but for smaller jobs, requiring either rail tongs or a hook, time is saved by drawing the bucket in close to the front end of the crane and releasing only the lifting rope for such lifting as the temporary job requires.



Above — cranes equipped with clam-shell buckets were used extensively in deep ditching work.

At left—a shovel-equipped machine working in close quarters on the right-of-way

An illustration of this latter practice is afforded where it is desired to move, or to load or unload a tie-tamper compressor or a unit of ballast cleaning equipment with a crane which is being employed in clam-shell work. Obviously, considerable time is saved by this short-cut which avoids the necessity of changing from a clam-shell to a hook, and in returning the crane to clam-shell operation. In like manner, such cranes as are suitably equipped can be temporarily converted for service with a magnet. However, in most cases, owing to the electrical cables necessary with the magnet, a crane is usually completely changed over for magnet operation.

In all of the various types of work which are being done with the crawler units, they are completely operated and controlled by one man, most of the operators having been selected from the regular maintenance of way forces. Fuel for the gasoline engines is usually delivered directly to the site of the work in steel drums, on motor trucks, by the oil companies. Where the condition of the right-of-way is such that trucks cannot reach the machines where they are being operated, the fuel drums are usually delivered to the road crossing nearest to the work.

Cranes Suitable for Work-Train Service

The eight-ton crane being used on the Pennsylvania was adopted as the result of a careful study of the requirements of the work to be done, with consideration given to permissible loads and clearances when operated in connection with the standard work-train equipment of the road. These cranes can be operated in standard low-side gondola cars with sides up to three feet in height, but they are specially designed for use on flat cars of 100,000-lb. capacity, with lengths of 40 ft. over end sills, and with floor heights of 3 ft. 5 in. above the top of rail. The cranes themselves, in full working order, are designed not to exceed 43,000 lb. in weight, and the maximum permissible combined weight of the cranes and their loads, when moved from car to car in work-train service, is restricted to 55,000 lb.

Where there are no sides on the cars used in work-train service to carry the cranes, lengths of scrap rail have in some instances been turned over and spiked along both sides of the car floor with their tilted bases inward, to act as guides for the crawler treads. This precaution is not considered essential, but it obviates the necessity of the operator paying close attention to the position of the crane on the car, and enables him to give his undivided attention to the operation of the hoisting equipment.

The cranes load and unload themselves on the cars and pass from one car to another without difficulty. The loading and unloading is done from the end of the car, over an incline of switch timbers thrown up and blocked temporarily for the purpose, and then stored on the car for future use. In order to permit travel from one car to another, the cars in work-train service are provided with aprons, which are placed temporarily over the gaps between adjacent cars. Where brake staffs interfere with the movement of the cranes from car to car, it is necessary to remove the staffs and then to replace them. Suitable adjustable hold-downs are provided with each crane to secure the crane body to the traveling gear, and also to prevent the rotation of the crane while it is being carried in transit or is being moved from place to place in work-train service.

Machines Built to Specifications

In order that they might be adapted to a wide variety of work, and, at the same time, meet the limitations made necessary by permissible car axle loads and clearances, the cranes of the Pennsylvania embody numerous special features. In fact, practically all of the cranes were purchased on specially prepared specifications to insure uniformity and the most desirable features of operation.

The first few crawler-type cranes put in operation by the Pennsylvania were of 5 and 7½ tons capacity, and while they proved entirely satisfactory from a

mechanical standpoint, they did not possess the full possibilities for maintenance work, either in design or capacity. Recognizing this, specifications were drawn up for an eight-ton crane, which approaches the maximum in weight and dimensions allowable for movement and operation on the standard work-train cars of the Pennsylvania, and which, because of its increased capacity, is more universally adapted to maintenance of way work. All purchases of crawler-type cranes since the latter part of 1928 have been based on these specifications.

These cranes are gasoline-motor driven, with specially designed cabs and smooth treads. Specifications require that they have the following general characteristics:

Traveling speed over a level dirt road	90 ft. per min.
Rotating speed	1 to 4 r.p.m.
Hoisting speed with a 4,500-lb. line pull	125 ft. per min.
Maximum grade when mounting cars, etc.	20 per cent

Cabs Are of Special Design

The cabs provided on the cranes are of all-metal construction, and are specially designed with tapered rear ends to increase the operating range of the cranes without causing interference with train operation on adjacent tracks. So designed, the hoisting block of many of the cranes, when at 30-ft. radius, can be swung 12 ft. from the center-line of the track without any portion of the rear end of the cab projecting more than 5 ft. 1 in. from the center-line between the crawler treads. The cabs have sliding doors and windows, special grab-irons, removable sides to permit ready accessibility to the machinery for repair, and, in spite of their tapered ends, they afford ample room for an effective arrangement of machinery and for the free movement of the operators in the performance of their work. The outside of the cabs and all of the machinery are painted standard engine black, while the interiors of the cabs are painted gray.

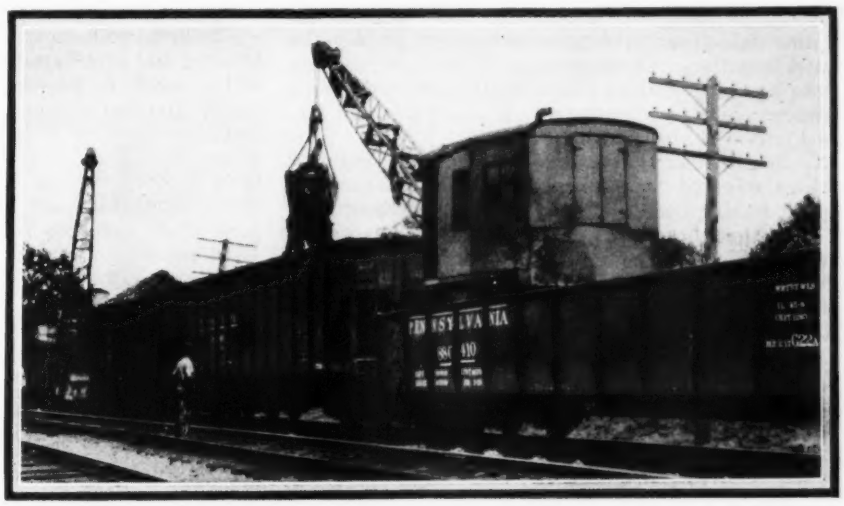
According to specifications, the limiting height of the cranes from treads to clearance is 11 ft. 6 in., while the maximum width to outside of crawler treads is limited to 8 ft. The maximum width of the cabs themselves is limited to 10 ft., and the minimum height under the revolving units supporting the cabs is set at 3 ft. 2 in.

The gasoline-motor power unit provided in each crawler machine is of the water-cooled type, with a full pressure lubricating system, and is designed to have a rated capacity of at least 52 hp. at 900 r.p.m. Each motor is equipped with a self-starter and is arranged so that all vital parts are readily accessible. Fuel for the motor is carried in a 50-gal. tank within the cab, this tank being equipped with a fuel gage and a hand-operated pump for transferring fuel from supply drums on the ground to the fuel tank.

Crane Boom Is 35 Ft. Long

All of the cranes on the Pennsylvania are furnished with 35-ft. lattice-type booms and with hooks or fall blocks, in addition to such other special equipment as may have been specified. The hoisting machinery in each unit is of the two-drum type, suitable for the various services required, and, like all other equipment provided, is controlled by levers entirely within the cab and clearly marked to indicate their functions. The hoist is operated under power for both raising and lowering operations, and is equipped with a holding brake so that loads can be held in any desired position.

All the cranes on the Pennsylvania, with their 35-ft. booms, were required to comply with the following rated capacities, the safe rated capacities extending to points where the creeper idlers begin to lift from the creeper treads when the boom is at right angles to the treads, and the tipping loads being based on 120 per cent of the safe rated capacities:



Crawler cranes in work-train service loading foul ballast

Radius in Feet	Safe Load in Pounds	Tipping Load in Pounds
12	19,000	23,000
15	14,000	16,000
20	9,500	11,500
25	7,100	8,600
30	5,600	6,800
35	4,500	5,300

In order to preclude overloading and possible overturning of the cranes, a tabulated list of the safe load capacities of each crane is posted on the inside of the cab, convenient to the operator.

While the cranes can be operated in a full circle if desired, they are each equipped with limit stops and snubbing devices to control the boom swing-offs in both directions. The usual stops provided permit the following range of boom swings:

12 ft.-0 in. to the right, to 12 ft.-0 in. to the left
5 ft.-6 in. to the right, to 5 ft.-6 in. to the left
12 ft.-0 in. to the right, to 5 ft.-6 in. to the left
5 ft.-6 in. to the right, to 12 ft.-0 in. to the left

Setting of the stops to control the boom swing can be done either from the ground or in the cab, thus giving greater flexibility of control.

The cranes equipped for magnet operation have a 7.5-kw., 230-volt, d.c. generator, belt or gear-connected to the gasoline engine and provided with a clutch which can be locked in both in and out positions. The magnet itself is 45 in. in diameter and has a rated lifting capacity of 1500 lb. of pig iron. The drag-line buckets furnished with a number of the cranes are of ¾-yd. capacity, while the shovel dippers supplied with the shovel attachments have capacities of ¾ yd. Auxiliary equipment furnished with each crane includes a metal locker within the cab for the orderly and safe storage of tools, suitable electric lights for illuminating the interior of the cab, and two floodlights of the automobile headlight type, mounted on swivel yokes, for night operation.

The Maintenance Problem

The maintenance and repair of the cranes have not presented a problem up to the present time, practically all work of this character being done by the operators. However, a traveling mechanic on each division makes periodic inspections of the machines, and handles such repairs as cannot be made by the operators themselves. It is planned to have a special mechanic from each regional headquarters make a thorough inspection of each unit once a year to determine which units require shopping during the winter months. All major repairs and overhauling of the equipment will be done at the Pennsylvania's maintenance equipment repair shops at Renovo, Pa., and Ft. Wayne, Ind.

No detailed accurate records of operating costs or savings effected by the crawler cranes have been kept, it having been sufficient up to the present time to know that these units of equipment are adapted to a wide variety of maintenance work, and can carry out the various items of work more expeditiously and more economically than has been possible with the equipment and methods employed in the past. All new equipment purchased and the general supervision of its operation and repair is being handled by a committee composed of the regional chief engineers maintenance of way and representatives from the departments of the general purchasing agent, the chief of motive power and the chief engineer.

Derailment Caused by Poor Track Conditions

THE derailment of an engine on a mine spur leading off of the Evervale branch of the Lehigh Valley on July 16, 1929, resulted in the death of one employee. The derailment occurred at a No. 10 frog in a right-hand turnout located on the inside of a curve of varying curvature, that of the turnout itself being approximately 17 deg.

The train, which was involved in the accident, consisted of a locomotive, with its caboose coupled ahead of it, and shoving 13 cars of coal through the lead-track switch, at a speed estimated to have been between 9 and 12 miles per hour. The engine and tender came to rest between the main track and the lead track in an upright position with the rear wheels of the tender on the frog; the caboose came to rest almost crosswise of the main track. No other cars were derailed or damaged. The employee killed was a trainman who either jumped or was thrown from the top of the caboose.

In his report of the investigation of the accident, W. P. Borland, director, Bureau of Safety, Interstate Commerce Commission, states that: "This particular engine has been used at various times on the Lattimer Colliery branch for the past several years, while engines of this class have been used regularly on this branch for the past four years. Careful inspection of the engine failed to disclose any defect that would have caused or contributed to the accident."

Track Condition Poor

In the vicinity of the point of accident there is a large mine-refuse pile and water seeps constantly from this pile into the track ditch on the north side, standing from two to three inches deep and at the level of the bottom of the ties. The track was out of gage and of uneven curvature, while the elevation varied and was not proportionate to the curvature. About 40 per cent of the spikes were pulled from ⅛ to 1 in. although the spikes still held firmly in the ties. There was some wave motion in the track under a moving train; where the spikes were partly pulled, the rails lifted under the spike heads and where the spikes were holding the rail firmly on the ties, the ties lifted up from the ballast. The frog involved was an old No. 10, 90-lb. solid manganese frog, which had been used elsewhere before being placed in the track following an accident on May 16, 1927. The condition of the spikes holding the frog was about the same as on the running rail.

The first two inches of the point of the frog had been battered and broken until there was no bearing surface and a small freshly-chipped piece of the point was found after the accident. The surface, near the point, was worn down ⅜ in. below the unworn surface of the wing rails; the wing rails had been worn from $\frac{1}{16}$ in. to ¼ in. by the treads of the wheels. There were thin cracks along each side of the point of the frog; the point itself had been forced over to the left and was ½ in. nearer the left wing rail than the right wing rail, the flangeway on the right side measuring 2¼ in. and on the left side 1¼ in. The gage of the track was standard at the point of the frog and at a point 22 in. in advance thereof; at the toe of the frog it was $\frac{5}{16}$ in. open; the elevation of the outside rail at these locations was $1\frac{9}{16}$ in., 1¾ in. and 1⅞ in.

Should Remedy Conditions

As a result of his investigation, Mr. Borland concluded that: "This accident was caused by poor track conditions. The track on the curve was not maintained in good condition; the roadbed did not provide a firm foundation for the track, the surface was not well maintained, and the elevation of the outside rail was not proportionate, or sufficient, to compensate for the curvature. The failure to provide sufficient widening of gage to compensate for the sharp curvature, allowed the wheels to crowd against the outside rail and increased the tendency to climb the rail; it also prevented the guard rail from fully serving its intended purpose of keeping the wheels away from the outside rail and thereby preventing extreme lateral pressure against the gage side of the outside rail and permitting free movement of the wheel to follow the curvature of the track. The derailing tendency due to the excessive curvature was greatly increased by the bad track conditions and the worn condition of the frog. While all these conditions are probably no worse than is general to many mine tracks on this and other railroads, yet it is obvious that they do not provide a sufficient margin of safety. Steps toward remedying such conditions, not only at this particular point but at other points where a similar situation may exist, should be taken immediately."

Great Northern and Milwaukee

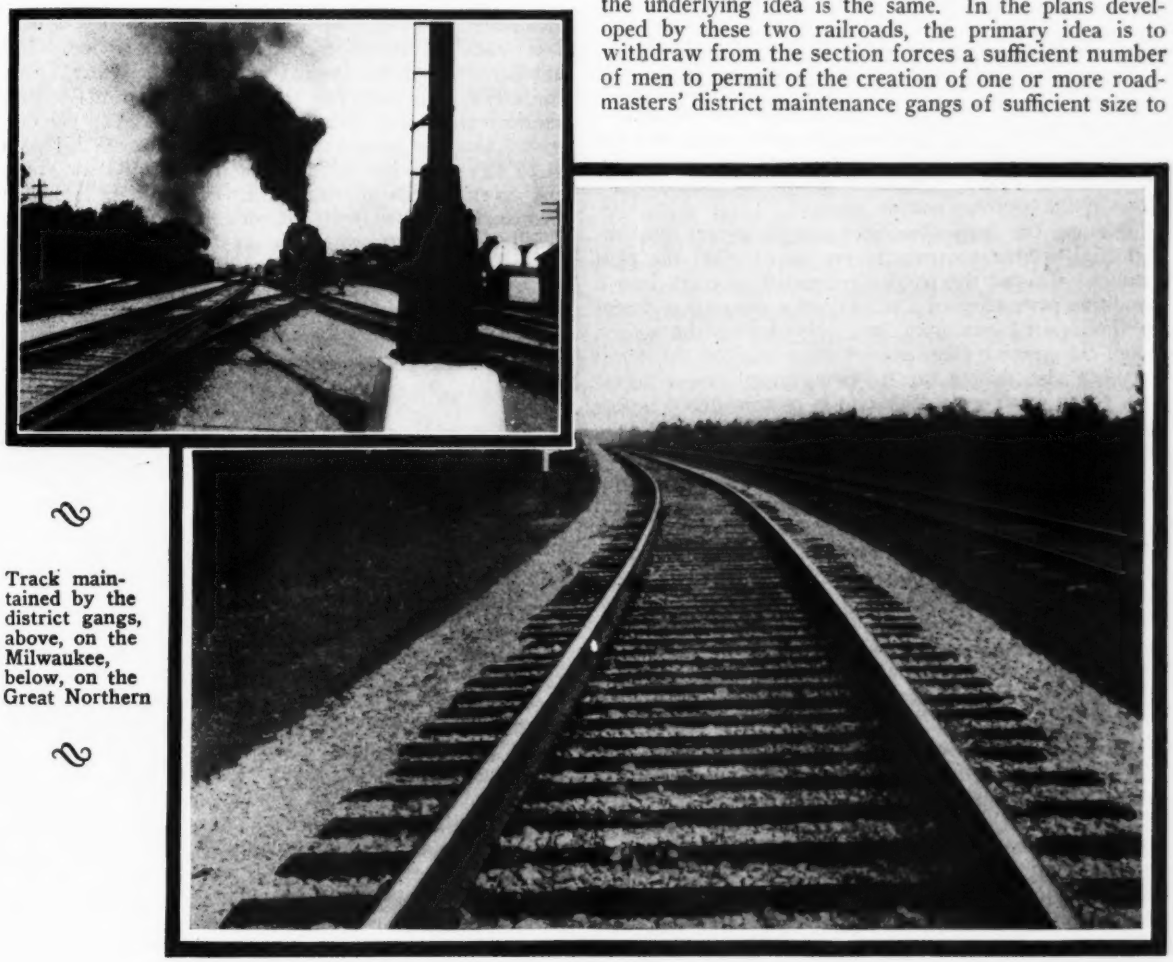
Turn to Larger Gangs

In effort to increase efficiency of ordinary maintenance these roads have developed plans of organization that meet requirements for effective use of labor-saving equipment

ONE OF THE chief stumbling blocks in the way of a most complete mechanization of track work is the size of the primary unit of the maintenance organization, namely, the section gang. With a force of only four to ten men, that has many different tasks to perform from day to day, it is impossible for the section gang to devote a sufficient amount of time to any one task to insure that power tools designed for the performance of such work will be kept busy a sufficient number of hours per year to pay the carrying charges on the equipment provided.

On a few intensively operated lines, this condition has been met by increasing the length of sections and the size of the gangs, or by a system of pooling the equipment under which two or more gangs share in the use of a single machine or set of tools. However, in the main, this plan has not been found applicable to the maintenance of way organizations of the majority of the railroads and, in so far as they are concerned, the problem of applying machine work to ordinary maintenance operations has not been solved.

It has remained for two roads in the Northwest, namely, the Great Northern and the Chicago, Milwaukee, St. Paul & Pacific to approach this problem from an entirely different standpoint, and although the details of the methods employed by these two railroads differ as to certain important features of their plans, the underlying idea is the same. In the plans developed by these two railroads, the primary idea is to withdraw from the section forces a sufficient number of men to permit of the creation of one or more roadmasters' district maintenance gangs of sufficient size to



Track maintained by the district gangs, above, on the Milwaukee, below, on the Great Northern

enable them to be employed continuously on out-of-face surfacing, carrying on as well all tie renewals within the limits of the mileage covered.

The work of such gangs should not be confused with that of the extra gangs employed in ballasting. These special maintenance gangs are designed to do exactly the same kind of work that the section forces are expected to do *when they get time* to do it.

With gangs of ample size and without the burden of the odd jobs imposed on the section forces, it is possible to schedule the work in such a manner as to permit the constructive and continuous employment of power equipment applicable to track surfacing. The details of the plans pursued on the Great Northern and the Milwaukee, something of the results secured, and an explanation of the distinction between the two plans are outlined in the two articles appearing below which deal with the work on the two systems individually.

Milwaukee Develops New Track Maintenance Organization

THE NEW form of track maintenance organization developed by the Chicago, Milwaukee, St. Paul & Pacific was applied last season to 28.3 miles of double-track main line on the La Crosse division between Grand avenue (Milwaukee, Wis.), and Oconomowoc. Under this plan the section gangs are reduced to mere skeleton units and the men so released are organized into a special track maintenance gang of which, as the scheme is more fully developed, it is planned to provide one for each roadmaster's subdivision. The purpose of the plan, as explained in the foreword, is to conduct ordinary maintenance work with a gang of sufficient size to insure that a complement of suitable labor-saving tools may be utilized effectively, and thus overcome the obstacle to the application of power equipment to the work normally done by the ordinary section gang.

Because the work described herein covers the initial trial, it was not exactly typical of what the plan implies. To put the particular stretch of track into a condition permitting of a reduction of the section forces to the desired minimum, not only during the season when the special maintenance gang was on the territory but also during the following year, it was necessary to do more work than would be considered a normal season's performance per mile of track after the plan has been in effect for several years.

The stretch of track embraced in the work during 1929 is a part of the main line between Chicago and the Pacific coast and carries 23 passenger and mail trains daily in addition to a freight movement of corresponding volume. This portion of the line traverses a rolling country involving moderate curvature and 0.5 per cent grades, except for a grade of 0.66 per cent against westbound traffic which is operated with helper service for a distance of about eight miles.

Nature of the Territory

All of the track in the territory in question is ballasted with washed gravel except for four-line miles ballasted with cinders. The rail is 90-lb. A. R. A. type-A section laid between 1922 and 1924. The ties are of various species of wood, for the most part treated and tie plated. The track in the particular stretch had not been included in a reballasting program for several years. This 28.3 miles of line embraces eight sections, averaging 7.2 main track miles each, which in the past have been allotted a summer force averaging five to six men per section including the foreman. In winter the force has normally been reduced to a foreman and one or two men.

Early in April, 1929, the section foremen were allotted two men each for the season's work and advised that the major part of the maintenance work would be performed by a special gang. They were given to understand that their work would be confined to inspection, policing, tie renewals on side tracks other than passing tracks, necessary spot surfacing and lining, and other routine work necessary for the safety

Tamping Ties with the Power Tamper

of the track and the protection of the company's property.

At the same time steps were taken to organize a special gang to handle what might be termed out-of-face track maintenance on this 28 miles of line. The number of men determined upon for this gang, 75, is considerably in excess of the equivalent normal section summer allottment to the sections embraced in the district. But the program for the conduct of this plan is to have the special maintenance gang work cover any given stretch of track at intervals of not less than two or three years, with the idea that the section force during the off year would be no larger than during the season that the maintenance gang is actually employed on it. Furthermore, the work of the gang during the last year included much that could not be embraced under typical section maintenance. The tie renewals were heavier than normal, and on six miles of main track this gang carried out a complete reballasting involving skeletonizing and tie spacing. In addition, the gang also replaced all of the angle bars on the main track with crowned bars preparatory to the building up of rail ends by welding, which was done by a separate gang.

Endeavor to Employ Men Locally

As the maintenance gang was designed to take the place of a part of the section men who would normally have been employed, every effort was made to recruit the men locally. Advantage was taken of the fact that a local passenger train passed over the territory assigned to this bang between 7:23 and 8:11 in the morning and returned in the evening between 5:29 and 6:23, by arranging to stop this train wherever the outfit was at work to pick up or unload the men who desired to travel to and from their homes, an extra car being provided for them. In addition, a high grade camp outfit was provided for all men who desired camp accommodations. However, it was not found possible to recruit the gang to full strength by this method and arrangements were made to ship men from Chicago to fill out the force.

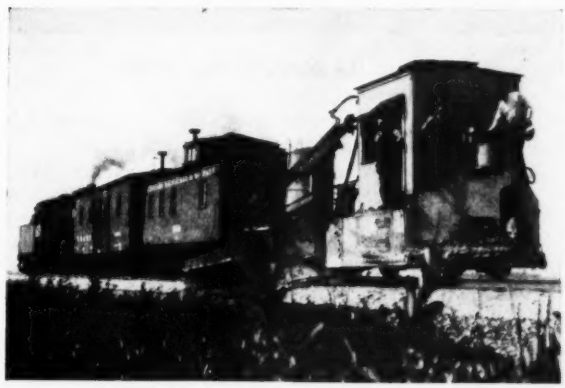
This maintenance gang made all tie renewals in this 56.6 miles of main track and about 10 miles of sidings. On the first four miles west from Grand avenue, this was done in connection with spot surfacing, but on all the remaining mileage it was carried on with a program of out-of-face surfacing. Except for six miles of main track which was reballasted, this resurfacing embraced a lift averaging about one inch. For this work, new ballast was applied only for dressing, and averaged about 200 cu. yd. per mile of track.

Provide Power Tools

The equipment furnished included a Nordberg track raiser and an eight-tool tamper outfit furnished by the Electric Tamper and Equipment Co. In addition, the force employed in renewing angle bars was provided with a Woolery power bolt tightener, while a Jordan spreader equipped with special ballast-shaping wings was used for dressing the ballast section. These last two units, however, are not considered as standard equipment for gangs engaged in normal maintenance work under this plan.

The tie renewals were heavy, but varied greatly in different stretches of track. Consequently, the organization of the force had to be adjusted to meet conditions as the work advanced. However, with respect to one feature of the work, namely, the tamping, the organization was kept uniform throughout the season. The distinctive feature of the arrangement for handling the tamping lay in the mounting of the engine-generator set on a light four-wheel truck, which was pushed along the track as the work progressed. Push-plug sockets provided for cable connections on this truck, together with the plan of having one squad of four tampers work in advance of the machine and the other squad in the rear of it, obviated the need of long conductor cables. In fact, a length of 30 ft. is all that was required for each tool.

The manner of tamping is also of interest. Two men tamp the ends, one on one side of one end of the tie and the second on the other end on the opposite side.



Shaping the Ballast with a Jordan Spreader

Two other men tamp inside the rails, one on one side of the tie tamping one-half and the other on the other side the other half. Thus, each man tamps his own part of the tie which is tamped *from one side only.* This is a standard practice on the Milwaukee in power tamping of gravel ballasted track and was adopted after careful tests, which included the jacking up of track after tamping to permit the removal of ties for an examination of the tie beds. With gravel ballast of the size and grading used, tamping from one side only results in solid bedding across the entire width of the ties.

Another distinctive feature of the Milwaukee's practice is the size of the tamping organization, 16 men and a machine attendent. The purpose of 16 men, or double the number of tools, is to permit of alternating or "spelling" the men on the tampers. It is true that the eight spare men serve in a measure as helpers, holding the cable or feeding ballast. But as a matter of fact, they are virtually getting a relief period. This plan was adopted after a thorough study of performance had been shown to give a much greater output per tool and nearly as large an output per man as that under which one man operates the tool continuously. It also results in better and a more uniform quality of the work, since the fatigue incident to continuous operation leads to greatly decreased output and poorer work toward the end of the day. The work was conducted with the track upon which operations were in progress out of service, all trains being operated single track between crossovers during the working hours.

The Generator Set Is Mounted on a Light Truck

No new ballast was supplied for surfacing, but as stated above, an average of about 200 cu. yd. per mile of track was delivered for dressing, whenever the gang had advanced far enough to require a day's service of a work train in dumping ballast and dressing the track to the standard contour with a Jordan ballast shaper. This work was done entirely by the machine, it being unnecessary to have any men complete any part of it by hand.

Size of the Gang

The maintenance gang was employed on the track between Milwaukee and Oconomowoc from April 19 to September 24 when it was moved off the division to be employed elsewhere as an extra gang on rail renewals and other work. During the 147 days that this gang was employed on maintenance work, it averaged 84 men. However, as from 10 to 12 of the men in this gang were employed on angle-bar replacement, the force employed on surfacing and tie renewals averaged only about 73 men, and inasmuch as the work included six miles of ballasting and the tie renewals for all but about eight track miles were unusually heavy, the performance cannot be said to be entirely typical.

The track rides well, thaws during February, after severe cold weather in December and January, having resulted in but little unevenness of surface which was confined primarily to road crossings or stations where it is difficult to provide adequate drainage.

With the close of the season, the section force was further reduced to a foreman and one man for the winter months and it is planned to confine the force to a foreman and two men during the coming summer. No trouble is anticipated in having this limited force maintain the track for at least a year without the aid of

the maintenance gang, which will be employed on another part of the district when it is organized next month.

This plan has been developed and carried out under the direction of William Shea, assistant engineer maintenance of way of the Chicago, Milwaukee, St. Paul & Pacific, to whom we are indebted for the information presented above.

Great Northern Reorganizes Its Track Maintenance Forces

DURING the last three years, the Great Northern has also carried out a rather distinct modification of its track maintenance organization. The primary purpose of this is to effect greater economy in the utilization of labor, but its inception at this time comes as a result of a desire to develop a more effective utilization of mechanical equipment than is possible under the prevailing form of organization. In brief, the plan provides that a portion of the force allotted to the section gangs is assembled in so-called "district gangs," of which two are normally assigned to each roadmaster's district.

The plan is somewhat similar to that on the Chicago, Milwaukee, St. Paul & Pacific, but with this important difference on the Milwaukee, the force for the district gangs is made available by decreasing the size of the section gangs, whereas on the Great Northern the men for the district gangs are provided, without an increase in the total force, by a reduction in the number of sections.

The advantage accruing from the new form of organization is derived in large part from the greater efficiency with which work can be done by district gangs adequately equipped with power tools, which obviously cannot be provided for each section gang. But a further gain results from the fact that the reduction in the number of section gangs tends further to simplify the decrease of the track forces to a winter basis. A large part of the Great Northern is located in country of severe winters and it has been the experience of the management that productive work is impractical in winter. Consequently, it has been the policy to reduce the forces each winter to a skeleton organization, the duties of which are confined primarily to policing and such emergency work as is incident to the occasional winter storms. With the greater mobility of section forces as a consequence of the replacement of hand cars by motor cars, it is possible for the section foreman to inspect a longer stretch of main track with the same facility that he could oversee a shorter stretch with a hand car. In other words, the transfer of a part of the section force to the district gangs (which are employed for the six summer months only) results in an actual reduction of the forces in the winter.

The introduction of this new form of organization was prompted also by the thought that too small a part of the time of the section gangs is being applied to out-of-face work. The reason for this is obvious. The section foreman's first responsibility is for the safety and riding quality of the main track under his jurisdiction and in his efforts to meet the requirements imposed by these responsibilities and to make the tie renewals and do other routine maintenance work, he finds little opportunity to carry out any general overhauling of the tracks of his section.

This plan was set on foot in the spring of 1927 when four roadmaster's districts, ranging from 118 to 180 miles in length, were selected for the first year's trial. The districts selected were located in Minnesota, North Dakota, Montana and Washington, thereby making the trial under a rather wide range of climatic and physical conditions. Assuming an average district of 150 miles, the plan is substantially as follows: On a district of this length, which had 18 sections averaging 8 miles each, the number of sections was reduced to 12 averaging 12 miles each. The reduction in force thus effected was compensated for by organizing two district gangs of from 20 to 25 laborers each, depending upon the previous normal active season's strength of the section gangs eliminated. These district gangs are employed only during the active season for a period of approximately six months. Therefore, the organization under the old and new plans may be compared as follows:

	Old Plan	New Plan
Active Season		
Section gangs on summer basis	18	12
District gangs	None	2
Off Season		
Section gangs on winter basis	18	12
District gangs	None	None

This plan does not in any way affect the employment of extra gangs which are engaged as heretofore on major items of track work, primarily, ballasting and rail renewals. The district gangs are not engaged in any work commonly assigned to the extra gangs.

One of the District Camp Outfits

The work done by the district maintenance gangs is, however, predicated in a measure by the schedule of ballasting done by the extra gangs. This schedule provides in a general way that main tracks on ballasted lines are to be given a complete ballasting, with a lift of about two to six inches, immediately following rail renewals, and occasionally at such other times as conditions may require. The work of the district gangs is scheduled so as to give all track an out-of-face resurfacing with a light lift (½ in. to 3 in.) at some time between complete reballastings. To meet this schedule, the plan provides that the district gangs resurface two miles, or about one-sixth, of the main track on each section each year, except during years that the section is included in the schedule of extra-gang resurfacing work.

In addition to the surfacing, the district gangs make all tie renewals required in the mileage covered by their schedules, removing all ties that cannot be expected to last two years.

The section foreman is advised each spring of the stretch of track on his section that is scheduled for district-gang work during the season and also of the

stretch to be covered during the following year. The object of this is to insure that he is fully informed of the work to be done on his section, as he makes no tie renewals on the stretch to be covered by that district gang during the current year and is instructed to keep tie renewals to a minimum consistent with safety on the track to be gone over by the district gang in the following year. As a result, there are two miles of the section on which he makes no tie renewals and four miles on which the renewals will be very light. Except for this and the fact that he is expected to do no out-of-face work, the duties of the section foreman with respect to the work on his section are substantially the same as those on section work as carried out under the conventional form of organization. However, the amount of work accomplished on each section from year to year by the district gangs is such as to reduce the burden on the section gangs and make it readily possible to do the policing and light repair work on a larger mileage without an increase in the regular section force or of the total forces employed.

Section Gangs Do Policing

During the off-season, November to April, inclusive, when the section gang consists of a foreman and one or two men, the work is confined, as heretofore, to inspection and policing, keeping the switches clear of ice and snow, etc. This gang is required to cover the entire section on a motor car each working day, and on Sundays and holidays as specifically instructed. During the active season, the necessary inspection is performed by one of the men in the gang, who is required to cover the entire section on foot or on a hand-speeder each day with the usual equipment provided for a track walker, as well as oil for filling switch lamps. The section foreman is required to go over his entire section at least once a week and at such other times as conditions point to the need of supplemental inspection or patrolling.

The section foreman is held responsible for the safety of all of the track on his section, except that when the district gang is at work on his section, the district gang foreman is held responsible for the safety of the track that is immediately under his charge, following the rule commonly in vogue with respect to extra-gang work.

One of the important reasons for the organization of the district maintenance gangs was to afford opportunity for the more effective use of power tamping and other machine tools than would be possible with section gangs that are constantly called on to do other work, thereby resulting in excessive idle time for the power equipment. The district gangs are equipped with four-tool power tamping outfits and the surfacing work is organized with a view to keeping the tools at work almost constantly. A typical organization for a district gang for surfacing is given below:

1 foreman	4 tamping men
4 jack men with 2 jacks	2 filling in
1 levelboard man	1 machine operator
2 spacing ties	1 camp watchman
4 renewing ties	2 flagmen

This gang will raise from 500 to 600 ft. of track per 8-hour day, while actually on surfacing work, as its progress must be interrupted from time to time to do the filling, lining and dressing. In order for the four tamper men to keep up with the gang as organized, they tamp only the ends of the ties and beneath the rails, going back to tamp inside the rails whenever the progress of the gang is delayed, or while the work is being started in the morning before the jackmen have had an opportunity to get their work well under way. This supplemental tamping is also done while the rest of the gang is dressing the track.

Each district gang is housed in standard bunk car equipment, that is moved over the district as the work is advanced. This means a considerable increase in the number of units of such equipment required. However, the reduction in the number of section gangs means a reduction of one-third in the number of section headquarters to be maintained, a saving that will more than offset the carrying charges for the additional outfit cars required.

This new plan of organization was developed by J. R. W. Davis, chief engineer of the Great Northern. We are indebted for the information presented above to R. S. Kniffen, who, as general roadmaster until February 1, was responsible for the development of the plan on the Great Northern, Lines East.

On the Northern Pacific West of Livingston, Mont.

What About Obsolescence?

In a well considered plan for purchase and maintenance this factor has little influence

By C. J. GEYER
Assistant to Vice-President, Chesapeake & Ohio, Richmond, Va.

IN PRESENT day discussions of transportation and industrial policies and methods, we often hear the expression, "This is a machine age." Every manager of a wide awake industry is aware of the necessity of cutting production costs and improving the quality of his product. His most valuable aid in bringing this result about is modern machinery, adapted to his needs. Managers of such industries do not hesitate to make large investments in labor-saving machinery and then scrap it as soon as new machines are available to do the work more economically.

The use of machines in industry and in railway maintenance is not exactly similar, however. Industry makes its products at a fixed location and under fixed conditions. Railway maintenance is extended over an entire railway, and must be done under widely varying conditions and circumstances on different parts of the same road. This comparison is made to show that the reasons advanced for the use and scrapping of machinery in an industrial plant, do not find a parallel for similar action in maintenance of way work.

Up to about ten years ago, the railways did not use machinery for promoting economies to so great an extent as industries. For some time, however, railway managements have been more appreciative of the utility of labor-saving equipment and its resultant economies, and rapid advancement has been and is being made in this field. It seems only necessary to imagine a need, and a device is brought out to meet that requirement.

Must Improve Methods

Every maintenance engineer is aware that railway methods must constantly improve, if the roads are to keep pace with the keen competition of other means of transportation. In the last decade we have seen a vast improvement in railway transportation brought about by an absolute need for this improvement. The maintenance of way department has contributed its share in this improvement, largely by machines and equipment, through the use of which, maintenance work is being done better and more economically.

The demand for labor-saving equipment has created a healthy activity in this line, and on many railroads the investment in labor-saving devices for maintenance work is already large. It is readily apparent that the investment to this account will grow to a much larger sum within a few years. It follows, then, that such an investment must be planned carefully and protected after it is made. If this is not done, less benefit will be derived from this important development.

There are many things that tend to destroy the savings and other benefits which result from an investment in maintenance equipment, but the greatest of these probably is obsolescence. This is especially true during the period of rapid development, and the wide use of maintenance equipment is still in its initial stage.

Maintenance officers cannot refuse to use labor-saving equipment because they fear that the investment will be destroyed by obsolescence. These machines must be used for self preservation, but they can minimize the losses from this and other causes if the investments are carefully planned and properly supervised.

Idle Equipment a Liability

There is not a labor-saving device on the market for practically every maintenance requirement. A quick way to make initial savings by the use of these devices, is to buy one or more of each. This saving is soon wiped out, however, by having a lot of idle equipment on hand, which is, a usual result of hasty purchases. There is nothing to which deterioration and obsolescence attach quicker than to idle equipment and machinery.

Two dangers confront maintenance officers in this "machine age." The first is the failure to obtain labor-saving equipment, because they fear that it will shortly be made obsolete by a later improvement. The second is that they fear a loss, if all kinds of labor-saving equipment is not provided quickly. The result of this latter attitude is that such equipment is purchased hurriedly before a thorough study of the requirements is made. Either course will result in definite losses.

It is possible to get the full benefit from labor-saving devices, without material loss from obsolescence, but in order to do so, careful planning is necessary. The first step is a study of the maintenance work to be accomplished on the entire railroad. This study must embrace probable work several years in the future, as well as that to be programmed immediately. After this wider program is

mapped out, showing the amount and character of all work to be performed, it is then time to study the labor saving devices that are the most practical for each class of work. The proper amount of equipment may then be purchased, so that the work may be completed on time and the amount of work to be done and amount of equipment provided will balance as nearly as possible. It is also important that such equipment be used during the majority of the working days in every year. This is necessary, as a general rule, in order to realize a saving on the investment.

Now, with the necessary work carefully planned, and the proper amount of labor-saving equipment at work, it becomes necessary to watch the performance of this equipment to see that it is kept in proper repair and worked to maximum efficiency. An organization to perform this service will vary in accordance with the amount of equipment. No general plan can be set up for such an organization, however, that will fit the conditions on all of the roads.

What to Do with the Old Machines

The heavy traffic divisions require maximum efficiency from both labor and equipment, so that new equipment is usually placed on such divisions. Here it is worked to full capacity, and ordinary repairs soon become necessary. At first, these repairs are of minor importance, consisting usually of renewals of small parts. Gradually the repairs grow in importance, until major renewals are required. This is the time when maintenance officers in charge of the equipment have the first chance to fight obsolescence. Whenever a machine comes to the shop for major repairs, there is an opportunity to make the repairs with improved parts, that may have been designed since the original machine was purchased. Very often, the improvements may be applied for the same or a slightly additional cost over a replacement in kind. This procedure will keep the equipment in modern condition for a long time.

As the program expands, and the demand comes for more equipment, the older machines can be moved to the lighter traffic divisions and the latest models purchased for the heavy traffic territories. The older machines will do good work on light traffic lines, if they have been modernized from time to time as major repairs were made, but heavy repairs eventually become more frequent, if the machine is kept at work. Finally, the cost of repairs increases to a point where it is no longer economical to keep the machine in service. It should then be scrapped promptly, not because of obsolescence, but because the cost of renewing worn parts approximates the cost of a new machine.

Such a plan will result in a definite cycle for maintenance equipment, so that, during the entire cycle, the machines can be kept in a practically modern condition until they are worn out. The bugaboo of obsolescence is not serious in a well planned maintenance organization.

TEN YEARS AGO—President Wilson has averted the strike of the maintenance of way employees ordered for February 17, but the persistent question of railroad wages has been put over for settlement after the return of the railroads to private ownership. The conferees on the railroad bill have rewritten the labor provisions to insure that the wage question shall be taken care of by a proposed board of labor appeals.—*Railway Age*, February 20, 1920.

Defective Switch Stand Derails Freight Train

A REPORT made by the Bureau of Safety of the Interstate Commerce Commission on the derailment of a freight train on the New Orleans, Great Northern on June 15, 1929, is of special interest to maintenance of way officers, since the evidence indicated that it was caused by a defective switch stand. In this accident, the derailed cars collided with a passenger motor car which was standing on an adjacent siding causing the death of one employee and the injury of five passengers and one employee. The following is abstracted from the report:

The Points Fitted Properly

The motor car had backed into the siding to meet the freight train. The evidence was clear that the conductor of the motor car had closed and locked the switch after this car had entered the siding, and that the points fitted properly and were lined for the main track, the switch being a facing point for northbound movement.

As the freight train approached the switch, at a speed of 25 to 30 miles an hour, according to the testimony of the engineman, the switch target and points were in normal position. The engine passed over the switch safely, and possibly the first and second cars also passed over the switch before they were pulled off the track by the derailment of the following cars. The first nine cars and the forward truck of the tenth car were derailed, however, some of which struck the gasoline motor car, turned it over and practically demolished it, killing the baggageman and injuring the passengers and the motorman.

Switch Stand Was Worn

Immediate examination of the switch disclosed that it was still locked but lined for the siding. After the track was cleared, a second examination was made, but nothing was found wrong, as the switch operated properly and the points fitted correctly. Further tests, however, showed that the switch lever could be pushed down into place and locked without having the switch mechanism properly seated. On dismantling the switch stand, it was found that the bolt which goes through the inner sleeve and holds the spindle in position, was in defective condition owing to excessive wear. In addition, the square bottom of the sliding sleeve and the socket in the top of the star block also showed signs of considerable wear. While none of these conditions alone seemed sufficient to have allowed the switch to open, apparently the worn spindle, coupled with the wear on the bottom of the sliding sleeve and on the top of the star block, provided a combination which enabled the switch to be locked without being properly seated.

As a result of his investigation, W. P. Borland, Bureau of Safety, concludes that, "Apparently the result of this combination was that, when the conductor closed and locked the switch, the lost motion in the different operating parts of the mechanism resulted in the switch not being properly seated, thus allowing the points to open under the passing train. This defect was concealed, however, to such an extent that it would not have been noticed by the usual inspection given by the section foreman."

Electricity,
Its Place in Track Work

A Motor-Operated Bolt Tightener

An Electric Rail Drill

This form of power is adapted for operating many tools. The author presents arguments for the use of 25-cycle current

By D. G. BLACK
Supervisor Railroad Sales, Syntron Company, Pittsburgh, Pa.

IN THE country as a whole, electricity is today the most common form of power supply. On the railways, electric lights have generally replaced oil lamps; the telephone has, to a large extent, replaced the telegraph; shop machinery is being operated by electric power, through motors applied to the individual machines. This newer form of power has also made possible the development and widespread use of internal combustion engines, through its use for ignition.

Its first wide use on the railways was by the mechanical department, and large savings have resulted from its application to shop machinery. The intensive development of signaling has been possible only as a result of the application of electricity, and in this field it has practically eliminated all other means for controlling the movement of trains. This development has increased track capacities, provided safe operation and resulted in marked economies. It is only recently, however, that the maintenance of way department has recognized the advantages of electricity in the operation of roadway machines.

Sources of Power Supply

Only a few roads are so situated that they have power current available from transmission lines, for the purpose of operating roadway machines or tools. One eastern railway, with electrified terminals, has a 2,200-volt, 25-cycle single phase power supply line along its right of way. It has installed small capacity transformers every 900 ft. on the transmission-line poles, with a weather-proof plug and socket outlet. In this manner, it is distributing this current to the roadway forces at 110 volts for the operation of ballast-cleaning machines, tie-tampers and rail-laying cranes. Another road which has an 11,000-volt transmission line of the same characteristics, has installed a secondary 110-volt transmission line for similar purposes, with convenient outlets every few hundred feet. A third railway that is just starting its electrification program, is making provision for supplying 110-volt, 25-cycle outlets along the entire installation.

It is interesting to note that all of these roads have adopted 25-cycle single-phase, a-c. power at 110 volts, instead of the commercially popular 60-cycle power. Alternating current is used because of the smaller transmission losses. The main reason for using power at 25 cycle for roadway tools is that percussion tools will operate to better advantage at the lower frequency, while certain types cannot be made to work successfully at frequencies as high as 60 cycles. An important reason for the adoption of 110 volts is the decreased danger of shock, which increases with the increase of the voltage.

By far the greater part of the railway mileage of the country is not provided with transmission lines, however, so that, where it is desired to operate electric tools, the only recourse is to provide portable generating plants, which are operated by means of internal combustion engines. These portable power units are compact in design, comparatively small in size and light enough to be handled easily by a small number of men. Frequently, these units generate two-phase alternating current at 110 volts, 25 cycles, again stressing the importance of current having these characteristics, for the operation of track tools. While single-phase current is satisfactory, it is more desirable to use the two-phase power where it is available.

Many adaptations have already been made, whereby electric-driven machines and small tools have proved successful, and a number of others doubtless can be adapted to electric drive. Several rail-laying cranes now on the market are equipped with generating plants of sufficient capacity to operate the tools used in rail laying. So far, however, electric spike pullers are not available, nor have tie-scoring or adzing machines been developed for electric drive, although the latter are usually operated by small gasoline engines and could easily be designed for electric power. They could be worked to advantage in batteries, but with individual motor drive, from current generated on the rail-laying crane.

Driving spikes, tightening nuts on track bolts, boring ties, when necessary, and drilling for bond wires or track bolts, are a group of operations that can be handled conveniently by a self-propelled gasoline generating unit, since tools are available for each of these operations. In the same way current can easily be generated for welding the rail bonds for signal circuits or return traction current.

Larger machines and tools which are adapted for

electric drive, include portable rail saws, rail drills, milling machines, ballast-cleaning machines, concrete busters, ice breakers and tie tampers. Several different makes of electric tie tampers are on the market, and in these tools, up to the present, electricity has found its most extensive application to track maintenance. The manufacturers of this equipment have designed their power plants, however, so that they are capable of operating a large variety of other tools in order to enable as wide use as possible to be made of them.

A heavy-duty electric hammer, equipped with a stone point, is being used extensively for tearing up pavements and demolishing concrete and other masonry structures. A similar tool has been found successful for breaking ice around water pans, switches and water columns, on station platforms and in streams where ice accumulations endanger the safety of bridges or embankments. A marked advantage of this latter application is that the tools can be used in the severest weather without danger of freezing.

Recently arc welding has been developed and adapted for reconditioning rail joints, building up frogs and crossings and reclaiming worn switch points. Very practical equipment has been designed for this application of electric power, including motor-driven grinding machines for putting a finished surface on the built-up rail ends, for bevelling the rail ends and for dressing up the flangeways of frogs and crossings. The welding of manganese steel has heretofore presented a number of troublesome problems which electric welding has overcome, and dependable results are now being obtained in this application.

In addition to reconditioning rail joints, frogs, crossings and switches, arc welding is coming to be recognized as a valuable aid in structural steel erection and maintenance. Already a wide application has been made of arc welding in building construction. A number of instances are also on record of steel spans which have been reinforced by this method.

In addition to its application to track tools and other adaptations, electric power, generated by portable power units, can be used for lighting on construction jobs, in repairing tunnels and, in emergencies, for providing light at wrecks and washouts. As an example of the wide adaptability of portable generating equipment, one railway was able, recently, to maintain continuous operation of a power interlocking, by using one of these units during the failure of power from the local power company. Another road has placed such a unit in a box car, equipped with a panel board and switch control, to be held in readiness as an emergency unit, and moved to any point on the railway, for the operation of pumping stations, drawbridges, interlocking plants, etc., in case of a local power failure.

Other roads have provided bridge and building forces with portable generating sets and a complete line of electrically-driven portable tools for their work, including saws, chipping and scaling hammers, large hammers for cutting and chipping concrete and other masonry, chain saws, floor sanders, floor polishers and concrete surfacing machines, as well as lighting equipment of both the ordinary and floodlight types.

Maintenance of Electrical Equipment

Like all other forms of equipment, electric tools must be maintained properly if they are to be dependable. They have the advantage, however, that they are easy to maintain, if the proper organization is provided for this purpose. The railways have already built up an organization for the repair of motor cars and various types of roadway machines and tools. The men forming this organization are generally excellent mechanics, and their work has familiarized them with internal combustion engines and electrical equipment in its many applications, so that a separate organization is not necessary. The signal department forces are also familiar with motors and usually have facilities for repairing and rewinding them when necessary. Also, in many of the larger towns, there are electrical repair shops where major repairs can be secured quickly and cheaply.

Electricity is replacing other forms of power so rapidly in other lines of industry, that the writer believes that the railways have an equal opportunity, which they can accept to their advantage, for the operation of practically all forms of maintenance machines and tools, and that increasing provision will be made to utilize this extremely flexible form of power in ways that are not now conceived. It will be interesting to watch the future developments.

Milling a Housing for a Switch Point With a Motor-Operated Machine

A Portable Gas Engine-Generator Set

The Pavement Buster—Another Electrical Appliance

With the knowledge that service data demonstrating the economies accruing from the use of labor-saving devices in the maintenance of roadway and structures are of direct interest and value to our readers, we have endeavored to obtain records relating to many classes of power-operated equipment. The results of our effort appear, in part, below in the form of data showing the economies in actual performance of six types of appliances in widely diversified fields.

Proving Their Worth

Service data demonstrating the economies accruing from the use of labor-saving devices in maintenance of way

Use Power Trencher in Drain Tile Work

AN UNUSUAL application of power equipment in roadway work, that offers possibilities of more extended use, has been carried out on the Great Northern for the purpose of decreasing the cost of installing tile drains. It embodies the use of a power trenching machine and has resulted in a decrease of fully 50 per cent in the labor required for this operation.

The tiling is done in cuts where there are springs or where there are soft spots or streaks of quicksand that cause uneven heaving of the track. It is not intended as a substitute for adequate ditching. In fact, a special effort is made to keep surface water out of the drains so that their function is solely that of draining the roadbed. Accordingly, the trench is excavated just inside the roadbed shoulder.

The machine cuts a trench 18 in. wide which is carried to a depth of seven feet to insure that the drains will be below frost level. The material excavated is dumped by the conveyor on the side slope of the cut, where it remains until removed by the ditcher in subsequent ditching. However, if ditching is done before the tiling, the side slope is cut back sufficiently to make room for the spoil from the trencher, which is later distributed on the slope. The trencher also cuts the outfall ditch at the ends of the drain.

As 18 in. is the minimum practical width for the trench of the required depth, there is ample space for two lines of tile. Furthermore, as the cost of the tile is a minor item of the entire expense of the tiling operation, it was decided that it would be in the interest of economy to lay two lines of tile instead of one. The tile, which is six-inch glazed farm tile, is laid so that the joints in the two lines stagger. Thus, the use of two lines not only doubles the security against blocking, but the staggering of the joints also increases the resistance to displacement or offsetting at the joints. The drains are laid on a bed of from four to six inches of cinders which are used also to backfill the trench to the top. The cinders are dumped from cars on the shoulder of the roadbed opposite to that in which the trenching is done and are cast over the track into the trench by hand.

The normal force consists of a foreman, 10 laborers and a machine operator. One man places the tile, another passes the tile to him, while the other eight men backfill the trench. The force necessary for the backfilling depends upon the rate at which the machine completes the trench, which averages 200 ft. per day,

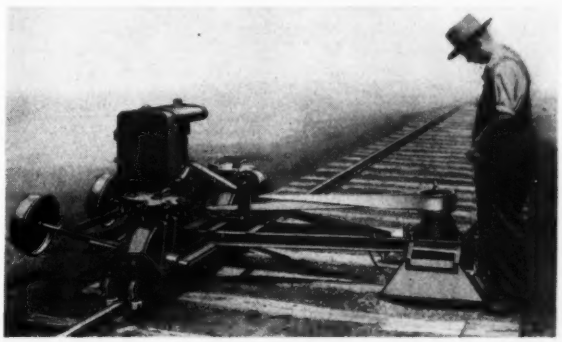
Parsons Trencher at Work on the Great Northern

but varies with the character of the material. If the material is soft or is inclined to cave, the progress is slower. The general idea is to keep the force as small as possible, and, if necessary, to call on the section gang for help when the backfilling gang cannot keep up with the machine.

The use of the trenching machine, which is a Parsons trencher, proved very successful during the season of 1929 when about 8,000 ft. of trench was excavated for drain tile. It is planned to continue its use during 1930 in tile drainage work and in addition to consider its application for cutting trenches in roadbeds on embankments to be backfilled with rock for the purpose of draining water pockets. The use of the trencher has been developed under the direction of R. S. Kniffen, who was until February 1 general roadmaster of the Great Northern Lines East, of Duluth, Minn.

Adzing Machine Found Efficient

IN relaying rail, the manner in which the ties are prepared to receive the tie plates is a task of primary importance. To reduce the mechanical wear on a tie and subsequent decay, it is necessary that the rail have a uniform and firm bearing on the tie and, hence, that the surface of the tie under the tie plate be level and smooth. To attain this condition by adzing the tie in a rapid and efficient manner, the



The Nordberg Adzing Machine in Operation

Nordberg Manufacturing Company, Milwaukee, Wis., developed the Nordberg adzing machine.

During 1929, four of these machines were used on a large western road in connection with the laying of 110-lb. rail. On one division where they were used, studies were made of the number of miles of rail laid during the weeks immediately preceding and immediately following the introduction of the adzing machines in the rail gang. These studies showed that, whereas 63 men were required in the gang when adzing by hand, only 54 men were required after the same gang was equipped with two adzing machines, a saving of 9 laborers. The operation of adzing the ties by hand required 16 laborers, while only 3 were actually required to operate the Nordberg machines, in addition to 2 men to drive down old spike stubs and 2 more with shovels to clean the ballast from between the ties to a depth of 2 in. below the top of the ties.

After using these adzing machines a short time, it developed that the most efficient method of operating them was to have one machine make the first cut and the second machine finish the tie. The third member of the adzing organization was retained to change the knives in the cutter heads and to check the work to make certain that all ties were properly adzed.

The reports show that during the last five days in which ties were adzed by hand, 13,494 ft. of rail was laid with practically no delays, or 2,699 ft. of rail per day. On the other hand, during the first five days in which the adzing machines were used, 21,333 ft. of rail was laid, with 6 hours of delays, or more than a day, as rail was laid only from 7 a. m. to 12 noon. After correcting for the delays, these figures show that approximately 5,330 ft. of rail was laid each day. Without taking delays into account, it was found that two machines will adze approximately 1,600 ties an hour.

During 27 working days in the month of July, a gang of 64 laborers on this road laid 7 track miles of rail, doing the adzing by hand, while in the same number of working days in August, 60 laborers laid 13 track miles, using the adzing machines, an increase of 85 per cent. Using these figures as a basis, it was estimated that the adzing machines increased the efficiency of the rail gang 25 per cent. All ties were adzed level, as canted tie plates were used, and, in placing them, the tie plates were laid against the outside score in order that no ridge of the plate would be under the rail if a train should pass before the track was fully spiked.

The greater speed of machine adzing over hand adzing was found to be the greatest advantage of the former method, although the quality of the work was also superior.

Power Jack Proves Its Worth

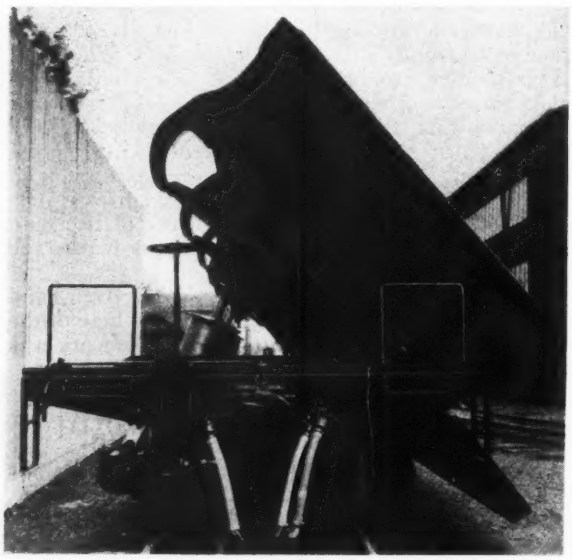
A NORDBERG power jack, manufactured by the Nordberg Manufacturing Company, Milwaukee, Wis., was recently used by a New England road on an extensive ballasting project where gravel ballast was replaced with stone ballast. Records show that this jack, with a force of 7 men, raised 900 ft. of track an hour, where the lift averaged 8 in. This road estimates that it would take a gang of 20 men, using hand-operated track jacks, to handle a lift of this size. Thus, with the power jack, the track-raising gang was reduced by 13 men. The average operation for a day, to keep in

The Nordberg Power Jack

advance of a tamping gang of 65 men, was 5,100 ft. and was done in 5½ hours. To handle the power jack, this road found that three men, by the use of the jacking foot and a pair of 4-in. by 6-in. wood skids, could easily move it to and from the track.

Saving Money in Cinder Disposal

WHAT may be saved in the disposal of powerhouse cinders, a task commonly imposed on maintenance of way forces, is indicated by cost records compiled by a railway on the economies realized by using five modern dump cars as compared with hand unloading from gondola cars. The savings effected resulted not only from the entire elimination



One of the New Dump Cars

of section labor in unloading, but also from the saving of per diem on coal cars which were loaded with cinders for the return haul to the mines.

The five cars purchased for this cinder-handling service are Magor air dump cars of the two-way, automatic, side-hinged, drop-door type. These cars are self-clearing and their unloading involves no manual labor, the dumping being done by the train crews. The statement of savings follows:

Cost of Cinder Disposal During 1926
Based on the record for 249 carloads

	Average per carload
Switching charges	$ 2.57
Per diem	6.53
Work-train service	2.44
Section labor for unloading	11.08
Total	$22.62

Cost of Handling Cinders with Magor Dump Cars
Based on the use of five new air-dump cars which handled 400 carloads

	Average per carload
Switching charges	$ 2.57
Interest at six per cent on investment	3.15
Depreciation	3.00
Maintenance $\frac{\$100 \times 5}{400}$	1.25
Unloading by regular train crew	.92
	$10.89

Average cost per carload handled in 1926	$22.62
Average cost per load handled with dump cars	10.89
Saving per carload	$11.73
Total annual saving based upon movement of 400 carloads. 400 × $11.73	$4,692.00

In addition, there is a further saving, based on a conservative estimate of $2 per car, in per diem charges on 400 carloads of coal, which were handled during the season in these dump cars from the mines to the powerhouse.

Total	$ 800.00
Total annual saving	$5,492.00

Power Drills and Saws Do Fast Work

A PORTABLE power saw has been used successfully by a middle-western road as an aid to doing smooth and efficient bridge and building work in a rapid manner. The saw was a Wolf, portable link, electric machine supplied by the Reed-Prentice Corporation, Worcester, Mass. It was equipped with a 1 hp. motor weighing 70 lb. and was used on jobs where electric power from power lines was available. Four tests were made by this road in sawing various types of bridge stringers and piles to determine the efficiency of the machine, the quality of work done and the best methods of utilization.

In the first test, eight old oak piles were cut off smoothly in 16 min. It was stated, however, that the time required varies somewhat, depending on the diameter of the piles and the skill of the operators in handling the saw. The time required to cut off these piles was materially less than that necessary to cut the same number of piles by hand. In the second test, 10 treated cypress piles were cut off fairly accurately in 15 min., this also being considerably less than the time required for hand work. The third test consisted in cutting off the ends of 12 treated fir stringers, 9 in. by 24 in. in dimensions. This job was finished accurately in approximately 20 min., a reduction of about 55 min. under the time required to do the same job by hand with a crosscut saw. During the fourth test, a bent consisting of six treated cypress piles was cut off in from 7 to 8 min. In this case, after the first pile had been sawed through, it was found that the 1-in. by 6-in. wood straight edge, which was used as a guide, had been sawed down to a depth of from 3/16 in. to ¼ in. Hence, while sawing the remainder of the piles in this bent, an effort was made to hold the saw slightly above the guide and the opinion was expressed that a guide somewhat larger in cross section, such as 2 in. by 4 in., or 3 in. by 4 in., would give more uniform results. As a result of these tests the conclusion was reached that two men using this saw can cut off a pile in from 8 to 10 min. less time than when using a cross-cut saw.

This road had 282 piles and 276, 9 in. by 24 in. by 20 ft., stringers to cut off at one point. Figuring on the basis of 6 piles to the bent and the fact that 62 min. would be saved on each bent by using the power saws, it was estimated that a saving in time of approximately 48 hours would be made on sawing the piles alone. Similarly, it was estimated that 55 hours would be saved in sawing the stringers with the power saw. In other words, the saw was estimated to effect a saving of 206 man-hours on this one job.

In addition to the tests made on the electric saw, this road experimented with an electric wood-boring

machine, in connection with which tests were conducted to ascertain the saving in time over hand methods in drilling various sizes of holes in piles, sway bracing, caps, fenders, and other types of construction timber.

It was found that with the power machine one minute was required to drill a 13/16-in. hole in a 15-in. treated cypress pile with a 4-in. sway brace, while the same job took 5 min. and 20 sec. when done by hand. The same performance was repeated on a 14-in. pile with a 4-in. sway brace, the power drill doing the work in 55 sec., while 5 min. and 5 sec. was required with a hand drill. To drill a 13/16-in. hole through three stringers, or 27 in. of wood, required 5 min. and 40 sec. by hand and 1 min. and 5 sec. with the electric drill. This road had 564 holes to be drilled in bents, 282 in caps and the tops of piles and 368 in stringers at one point, on which it was estimated that 4.36 min. per hole would be saved

An Electric Saw in Operation in Restricted Quarters

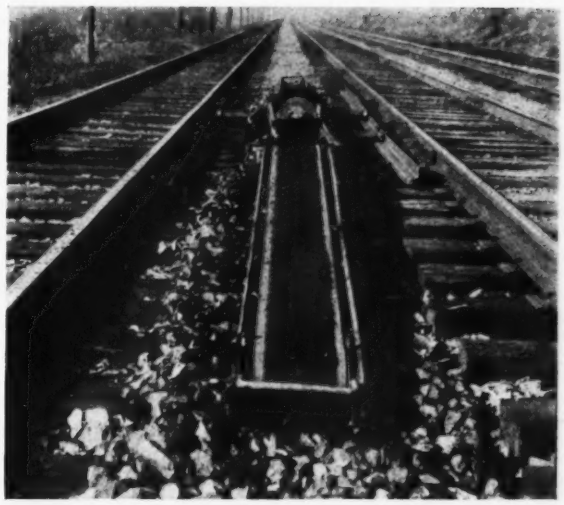
if the power drill was used, or a total saving of 88 hours.

Since these tests were conducted on the electric saw and drill, a 4-kw. portable motor generator set, furnishing 3-phase, 60-cycle, 220-volt current and powered by a 4-cylinder gasoline engine of 9.5 hp., has been procured and placed in service. This plant has sufficient power to operate simultaneously two electric wood-boring machines and one electric saw.

Ballast Mole Performance

THE swing conveyor, which was described in *Railway Engineering and Maintenance* for October, 1928, page 453, and which was developed by the Railway Maintenance Corporation, for application to the McWilliams Ballast Mole, eliminates the necessity of the crew carrying the dirt that is left in the ballast-cleaning operation, when working between tracks. This device reduces the force to one operator, two laborers and a flagman, thus effecting a marked reduction in the unit cost of the work done by the machine. The average operating crew, with a machine not fitted with the conveyor, requires from five to seven laborers, depending on the amount of dirt and the distance it must be carried.

The average cost for cleaning the ballast, when the conveyor is used, is said to be 5 cents per lin. ft., records of the performance of 149 of these machines, working on 14 roads, during 1929, having shown costs ranging from 3.4 cents to 9 cents. The cost per cubic yard of ballast cleaned averages 28 cents.

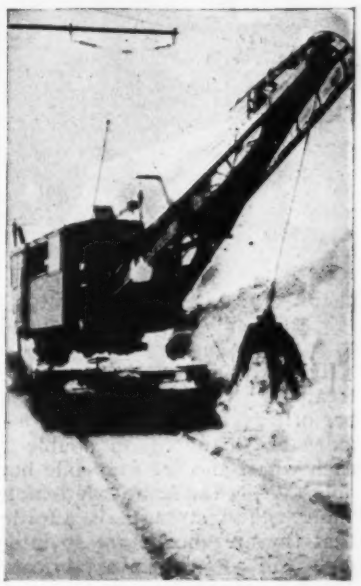


A Mole Equipped With a Swing Conveyor

These machines cleaned an average of 15.5 miles each, of inter-track space during the season, although a number of them exceeded 20 miles, and a few, working two shifts, exceeded 25 miles. The amount of ballast that can be cleaned, depends on the amount of traffic, the distance between track centers, the depth to which the ballast is excavated and the number of obstructions encountered.

Electric Ditcher Fights Snow

DURING the second and third weeks in January, when the El Reno line of the Oklahoma Railway, an electric road, was blocked with snow on three different occasions, this company's American electric ditcher, built by the American Hoist and Derrick Co., St. Paul, Minn., rendered unusual service in cleaning the cuts of snow drifts. In opening these cuts, which were filled with drifts to a depth of from two to nine feet, the ditcher, with its ¾-yd. clamshell bucket merely "holed them through" during the first trip through the cuts and on the second trip cut back the walls to smooth up the job and to prevent slides. By this method, the ditcher opened an 8-ft. cut at the rate of 75 ft. an hour. Since the Oklahoma is an electric railway, it was necessary to equip the boom of the ditcher with a trolley guard in the form of a basket-like arrangement.

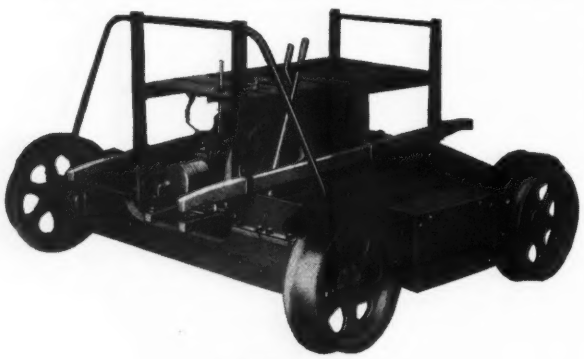


The Electric Ditcher Cleaning a Snow-Filled Cut

NEW AND IMPROVED DEVICES

New Inspection Car Weighs Only 390 lbs.

FAIRBANKS, Morse & Co., Chicago, are introducing a new light-weight, inspection-type motor car, which, while essentially a one-man car, has capacity for two and even three men, in addition to providing relatively large space on the deck for tools or similar equipment. The car, which is known as the Sheffield No. 46, weighs less than 390-lb. and, with the handles extended, has a lifting weight of 105 lb. or less. It is powered with a single-cylinder, air-cooled, two-cycle engine, which has a rating of four horsepower and is reversible, operating equally well in either direction. Power is transmitted through a non-destructible clutch, which may be slipped continuously without burning, and a roller



The Sheffield No. 46

chain. The action of the clutch is so light that it is said that only the pressure of one finger is necessary to apply the power.

The axles are made from chrome-manganese, heat-treated alloy steel, the rear axle being a forged member of tapered design without a center bearing. The axles are mounted on double Timken bearings at each wheel and the four axle boxes are interchangeable. While the front axle is not continuous through the car, full strength is afforded through the fact that the axle boxes are so interlocked to the front cross sill as to form a fabricated front axle. With this type of construction no loose wheels are required, thus permitting the use of a single type of wheel. Insulation is provided automatically by the fact that the wheels are of wood-center construction.

Throughout the car, heat-treated aluminum alloy has been substituted for iron and steel to reduce the weight without sacrificing strength. Wood brake shoes are provided on all four wheels, which is said to eliminate any tendency to spread the axles. Ignition is provided by an improved flywheel type magneto, which simplifies operation by requiring no attention after the car is in motion.

The car is regularly equipped with a front cross rail of aluminum alloy, and also a rear rail. Tool trays, 13⅝ in. by 35½ in., are provided on each side. All wheels are equipped with fenders.

A Dry-Dust Weed Killer

DURING the last year, a dry-dust form of weed killer, known as "Atlacide," has been developed by the Chipman Chemical Engineering Company, Bound Brook, N. J. This compound consists of 58 per cent calcium chlorate and is applied in a dry-dust form, covering the vegetation completely and then drawing moisture from the air to a point of complete deliquescence.

To apply the weed killer, a portable one-man container equipped with an air-operated duster has been developed, which fits conveniently on the back of the operator. This device consists of a bellows that is appropriately geared to a long lever which is held in the right hand of the operator. A slight motion of the lever causes a blast of air to be created, which expels the dust through a nozzle that is held in the left hand.

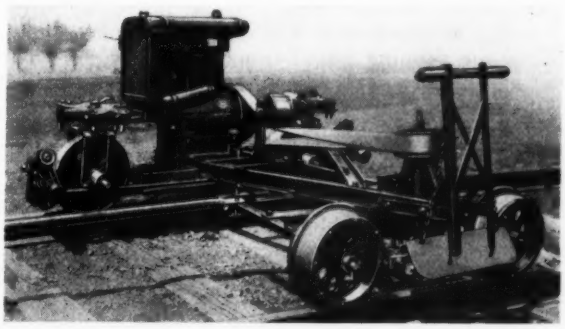
The container is in the form of a cylinder and will conveniently hold 25 lb. of material, which is sufficient to cover 2,500 to 5,000 sq. ft. of vegetation,

The Apparatus for Applying "Atlacide" Is Compact and Simple

depending on the density of growth. This apparatus is particularly convenient in ditches and around switch stands, signal devices, telegraph poles, the ends of culverts and patches on the ballast. Since it is in the form of a white powder the operator can insure the uniformity of his work in applying it.

Nordberg Improves Adzer

DURING the last year, the Nordberg Manufacturing Company, Milwaukee, Wis., has improved the design and construction of its adzing machine in several important features. The original model was mounted on three wheels, the third one of which, during the operation of the machine, was swung back as a counterweight to hold the cutter head above the ties. The latest model of this machine has four wheels, the two on the cutter-head side being lifted



The New Nordberg Adzing Machine with the Wheels in the Running Position

off as a unit and transferred to the opposite side of the machine, where they serve as a counter-weight to balance the cutter head. Also the type of gasoline engine for driving the adzing machine has been changed from the two-cylinder air-cooled engine to a water-cooled 8-hp. engine of four cylinders. These alterations were effected as a result of observations made during actual performance of the machine and are calculated to improve its appearance and its operation.

The Jordan Spreader for Fighting Snow

DURING the last year, the O. F. Jordan Company, East Chicago, Ind., has developed a spreader-ditcher with special attachments for heavy-duty snow fighting, which it has designated as the Jordan Type "A" spreader-ditcher. A special feature of this design is a front plow, which is equipped with manganese shoes for removing ice. This plow will flange to a maximum depth of 7 in. below the top of rail and can be raised or lowered 16 in. by compressed air. The plow extends 9 ft. above the top of the rails, at the center and 10 ft. 6 in. at each side. The side wings can be opened to any desired angle to push snow back a maximum distance of 22 ft. each side of the track.

All operations are controlled by the use of compressed air from the operator's cab, which is equipped with steam and stove heat, electric lights and double storm doors. The complete equipment weights approximately 147,000 lb., of which 100,000 lb. is carried by the front trucks. It is built to withstand the use of two of the heaviest locomotives in common use.

The Jordan Type "A" Spreader-Ditcher Equipped for Fighting Snow

It is emphasized in behalf of the equipment that at the end of the winter, the snow-fighting equipment can be removed in a few hours, leaving the spreader-ditcher ready for roadway maintenance work.

A New Section Car

THE Buda Company, Harvey, Ill., has recently placed on the market a new motor car, known as No. 166, with a capacity of 10 men and embodying new features in motor car construction.

The car is equipped with a single-cylinder, two-cycle, water-cooled engine having a brake horsepower of 10. In order to deliver the full horsepower of the engine at speeds varying from 15 to 35 miles per hour, the gear reduction is built into the crank case. By this means, the car can be provided to deliver full engine horsepower for heavy, slow-speed hauling with speeds between 15 and 20 miles an hour, or to handle light loads at speeds between 25 and 35 miles an hour.

The engine does not have a sliding base, but is

The Buda No. 166 Section Motor Car

bolted rigidly to the frame, the power being controlled by a belt tightener on ball bearings. Transmission is provided by an endless cord belt, which is controlled by a device built as an integral part of the engine. Two different pulley sizes are furnished as standard equipment. All engine bearings and gears are lubricated automatically by the oil that is mixed with the gasoline. The belt control mechanism is lubricated from a reservoir, which holds a supply of oil sufficient for one season, while the axle bearings are lubricated directly by oil can. Ignition is provided by four dry-cell batteries as standard

equipment, while a Robert Bosch magneto can be furnished as extra equipment.

The car is insulated on the left side, and is equipped with 16-in. pressed-steel wheels having a ¼-in. tread and a flange which conforms closely to MCB standards. The axles are of heat-treated steel having a high carbon content. They are 1½ in. in diameter and machined to conform to the proposed standard of the A.R.A. The axle bearings consist of two Timken roller bearings in each axle box, while the center bearing on the drive axle is equipped with a Hyatt roller bearing.

The frame of the car is constructed of steel and white oak, while the seat and floor boards are of pine. The seat is easily removed by one man after four bolts, which are easily accessible, have been removed. The safety rails are in the form of high arch members of curved pipe at each end of the car and if necessary they can be supplied in the same width as the frame. The flywheel and belt are protected by metal guards, which are standard equipment. The tool trays are 79 in. by 12 in. by 6 in. and the outer side sill is reinforced by a Z-bar, which also provides a fender for the wheels.

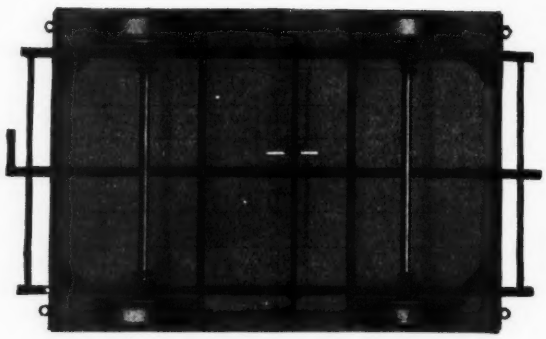
Four-wheel, hand-operated brakes, with adjustable toggles to take up wear, are a feature of this car. It has a wheel base of 40 in., weighs 1,090 lb. and may be handled by two men.

A New Heavy-Duty Trailer

A NEW heavy-duty combination gang trailer and work car, which is designated as the Casey Jones 562, has been developed by the Northwestern Motor Company, Eau Claire, Wis.

One of the features of this car is the frame construction, which is entirely of steel, being made from five-inch steel channels that are bolted and riveted together. Further stiffening is provided by steel braces and gusset plates. The axles are two inches in diameter, are provided with adjustable collars to counteract lateral thrust, and are equipped with Timken roller bearings. The wheels are constructed of 5/16-in. pressed steel plate and are 20 in. in diameter. The seat frame is also constructed entirely of steel, being made of 1½-in. angles. A steel drawbar, which extends the full length of the car and projects a short distance at each end, is bolted securely to the frame under the platform and is provided with a forged H-type drawbar link.

The Seat Frame of the Casey Jones 562 Is Easily Removed



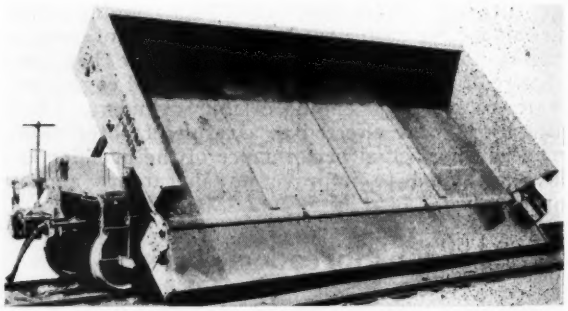
Showing the Under-Frame Construction of the Casey Jones 562

The superstructure, which consists of the seat and safety rails, is detachable from the frame, as are also the running boards, which are removed by withdrawing a long steel rod that, when in place, locks all of the running board supports in position. The car has a seating capacity for 12 men and is provided with safety railings on both ends, which provide protection for all occupants.

Dump Car for Ditching Service

A DROP-DOOR dump car of 20 cu. yd. capacity, has been placed on the market by the Western Wheeled Scraper Company, Aurora, Ill., which has been designed and built especially for railway ditching service, although it is equally well adapted for steam shovel service or other work where a car of this capacity is desired.

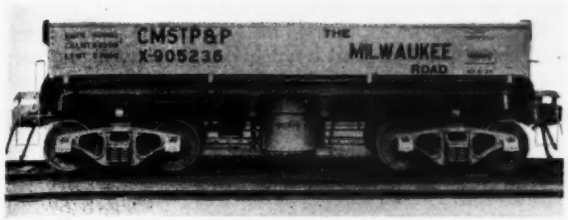
The features which contribute to the adaptability



The Drop-Door Dump Car in the Dumping Position

of this car for ditching service are its short bed and low height from the top of rail to the top of the car. These features enable the car to be fully loaded without moving it ahead and without shoving the material to the far end of the car with the ditcher dipper; they also allow the ditcher to function at the maximum depth below the rail. The car is 4 ft. shorter than the standard 20-yd. car, having an inside length of 22 ft. and an overall length of 29 ft. 8½ in. The height, measuring from the top of the rail to the top of the car, varies from 7 ft. 6 in. to 7 ft. 10 in., depending on the type of floor construction.

The drop door, when in the drop position, extends 4 ft. 8 in. out from the rail, thus keeping the dumped load off the ballast and the track clear for following trains. Ready discharge of material is afforded by the 50-deg. angle of dump. It is said that the car has stability while operating at high speeds and that the



The Dump Car Is Short and Low

dumping action is positive and fast with a low air consumption. The piping is so arranged that the car operates from the air brake line of the train at air brake pressure, without special air connections or air lines, and it is said that there is no interference with the action of the air brakes. The car may be dumped while in motion.

Baffle Sheets for Discers

A STEEL baffle sheet has been developed by Fairmont Railway Motors, Fairmont, Minn., to prevent light ballast, such as cinders, chatts or light gravel from becoming displaced while being worked with its M23 discer. It has been found that this type of ballast is thrown out of place if disced at a speed greater than 7 miles per hour, while it is said that, with this new equipment, discers may be operated at speeds up to 12 miles per hour without harming the ballast section.

The baffle sheet consists of a long piece of sheet metal, which is attached to the discer arm directly in the rear of the discs and extending to within a few inches of the ballast. Displaced ballast is thrown against this shield and falls back on the shoulder in

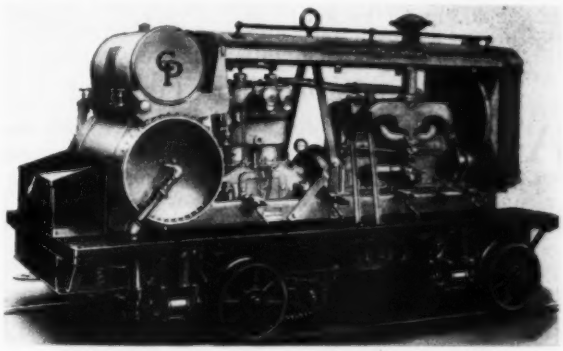
The M23 Big Discer Equipped with Steel Baffle Sheets

a smooth layer. The increased speed of the M23 discer, permitted by this equipment, reduces the cost of discing track considerably by raising the out-put from 7 miles to 12 miles per hour with practically no increase in the handling cost. In addition to the baffle sheets, the M23 discer is now equipped with a two-cylinder air compressor with Timken bearings on the crank shaft, a Continental 30R Industrial, six-cylinder, 81.5-hp engine, and has a wheel base of 110 in.

A New Portable Air Compressor

AN air-motor operated, self-propelled, portable air compressor has been developed by the Chicago Pneumatic Tool Company, New York, which embodies a number of new features in the design of portable air compressors.

The unit is propelled with a CP No. 6 Little Giant air motor, which is mounted on the under-frame and is connected by a rotor chain to the driving wheels of the truck. All operations of this motor are controlled by a single lever and the normal operation of the compressor is not affected when the propelling mechanism is being operated, this being an advantage on work in



The New CP Air-Motor Operated, Self-Propelled, Portable Air Compressor

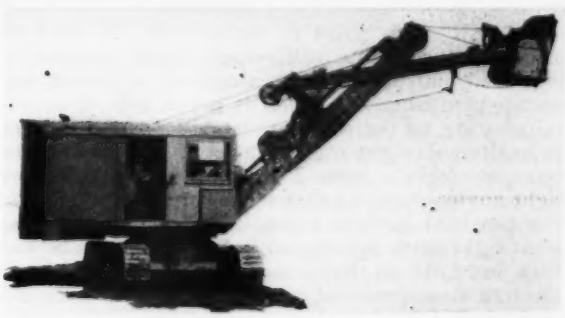
which the compressor must be constantly moved forward, such as tamping ties, driving spikes, laying rails and bolting joints. The machine is equipped with air-operated jacks and transfer wheels to assist in removing it from the tracks. It is also equipped with a lifting bale, which is conveniently placed.

The compressor is powered with a gasoline engine and is available in sizes of 110, 160, 220, 265 and 310 cu. ft. per min. displacement. The unit will attain a speed of 15 miles per hour.

A Close-Quarter Crowd

A NEW close-quarter crowd has been developed by the Northwest Engineering Company, Chicago, which permits a shovel to be equipped with an extremely short boom and long stick and enables the bucket to be extended out to the limits of the stick, independently of the hoist, either before, during or after hoisting.

Under ordinary operating conditions, crowding is accomplished in the normal manner of Northwestern



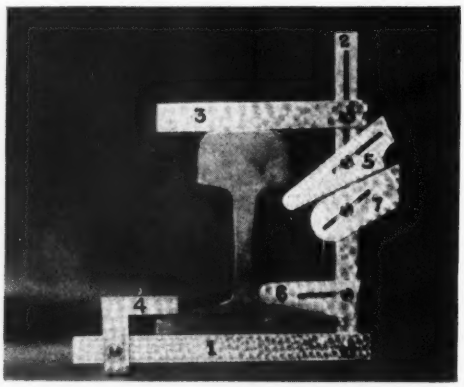
A Shovel Equipped with the New Close-Quarter Crowd

equipment, but, if occasion demands that the bucket be forced on long sticks beyond a short boom, the new method provides this crowd entirely independently of hoisting. By use of the new crowd, the hoist may be held at any desired point, while the bucket is thrust in or out without the necessity of holding it up with the engine and with no danger of dropping it. None of the engine power is divided between crowding and digging, and ordinary digging operations are unaltered from the standard Northwest cable crowd.

It is said that the new crowd is especially applicable where space is limited and when the bucket must be extended high or wide as for loading trucks. Its mechanical features are simple and it is said that all operations may be executed in rapid succession, thus enabling the bucket to be shaken with sufficient violence to dislodge adhering material.

An Adjustable Rail Templet

AN adjustable templet, designed specifically to facilitate the making of rail section and angle bar measurements in the field to determine the amount of head and fishing wear, has been developed and put on the market by the Rail Joint Company, New York City. The instrument is a relatively simple device, consisting of seven parts, made of aluminum alloy. Among these parts are a slotted vertical arm 9 in. in length; a lower horizontal arm 8½ in. long, which fits under the base of the rail; a second horizontal arm, 5⅞ in. long, used over the top of the rail head; and three slotted adjustable wings of various shapes and lengths for use alone or together with the horizontal and vertical members in making the various measurements possible with the device. Another member consists of an angle attachment to the horizontal base piece, to hold the templet on the rail while measurements are being made. All seven parts of the templet are held in place by knurled nuts or hand-set screws, and can be separated and packed conveniently in a pocket-size leather case when the device is not in use.



The Templet Adjusted for Measuring the Height of Rail

Referring to the illustration, Arms 1 and 2 have an unalterable right angle connection with each other when assembled; Arms 2 and 3 are likewise fixed at right angles, Arm 3 being moved up and down in a slot provided in Arm 2; angle piece 4 bears a constant right-angle relation with Arm 1, but can be slid back and forth on that arm; while Wings 5, 6 and 7, through slots provided in them and in the vertical member 2, can be made to assume any of a number of positions necessary to make the different measurements of the contour which may be desired.

With the device clamped on the rail, dropping Arm 3 to the top of the rail head gives the height of rail; the use of Arm 3 and Wing 5 together enables the thickness of the head to be determined; Wings 5 and 6 make possible the determination of the fishing of the rail; Wing 6 and Arm 1 are used to determine the thickness of the base of the rail; and Wings 5, 6 and 7 are used to determine the fishing of joint bars. None of the parts of the templet are graduated, so that in determining the dimensions sought, it is necessary either to compare the templet as adjusted in making the measurements with a templet drawing of the rail section, or to plat the angles produced by the templet members in making the measurements and then scale off the dimensions desired. In making measurements of angle bars or rail ends in the track, other than the height of rail, the angle bars at the joint must be removed.

As assembled in the illustration, the templet is in position for determining the height of rail. Wings 5 and 7 are not brought into play in securing this measurement.

This device is not intended as a precision instrument, but rather as a means to facilitate such field measurements as are usually made, and to make possible their determination with greater accuracy than is possible with the ordinary methods in common use.

The Pony Car Is Improved

THE American Trackbarrow, Lowell, Mass., has recently improved its Pony car by the addition of two new features. This car, which was developed some years, ago, consists essentially of a strongly braced platform, 52 in. by 16 in., equipped with two double-flanged, roller wheels in line with each other, and is provided with a long handle by means of a crescent brace at the side of the platform. A detachable wood box for hauling ballast is a part of the equipment which goes with the car.

One of the improvements is a steadying leg of 2-in. by 5/16-in. steel, which is attached to the handle near the platform and is supported on a convenient tie to hold the car erect, when the ballast box is being filled, thus eliminating the services of the laborer formerly required to perform this duty. The other additional feature consists of a detachable platform and tank holder, to be used to secure drums

The Pony Car, Showing the Detachable Platform, the Support and the Tank Holder

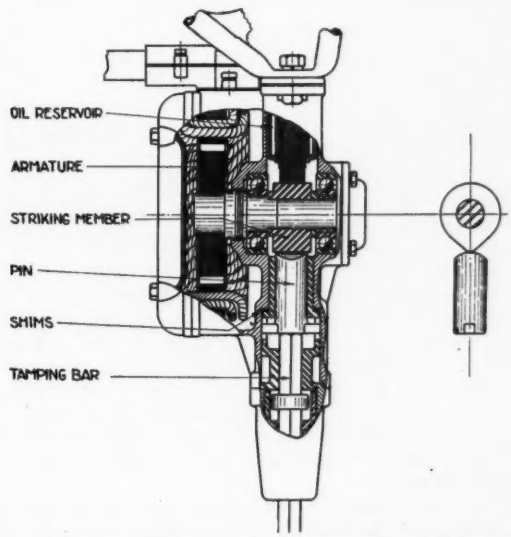
of gas when they are being conveyed on the car in connection with acetylene welding operations. The steadying leg is used in this connection also. The platform, which is 24 in. by 15 in., is constructed of 16-gage steel and weighs approximately 10 lb. It is equipped with a 1-in. flange on the outside to prevent the drums from sliding off, and lugs are welded to the bottom of the platform to keep it from sliding on the frame of the car. To prevent the drums from tipping off, an arm of 1½-in. by 5/16-in. steel is attached to the handle of the car and is equipped with chains which fit around the drums.

A Hammer-Blow Tie Tamper

A NEW electric tie tamper, known as the Jackson Hammer-Blow Type, is now being introduced by the Electric Tamper and Equipment Co., Chicago. This tamper is designed especially for use in "spot" surfacing where no raise in grade is involved. Power is provided by a ¾-hp. motor of the squirrel-cage type, which operates on 3-phase, 60-cycle current at 110 volts.

Side View of the New Tamper

One end of the shaft of the motor, which is of alloy steel, is provided with a cam which is called the striking member. Each revolution of the motor brings this cam in contact with the cylindrical end of a round pin which transfers the blow to the tamping bar, 1800 blows being delivered per minute. The cam and the end of the pin are the only wearing surfaces in the tamper and they are of heavy construction, are hardened and have large striking surfaces. The force of the blow may be adjusted to the type of ballast which is being worked by the use of compensating shims, whereby the end of the pin is moved toward or away from the cam. The blows of the tamper cease automatically when the pressure is removed, as there is then no force to keep the pin in contact with the cam. All parts of the tamper are lubricated from a reservoir which holds a week's supply of oil, and is situated near the top of the machine.



Mechanical Details of the Hammer-Blow Tie Tamper

Electric power is furnished by the same portable power units which are used to operate the Universal tie tamper, also manufactured by this company. These power units are furnished in either four or eight-tool sizes.

New Tool Sets Cut Spikes

THE Q. & C. Company, New York City, is manufacturing an entirely new type of tool in its field—a cut-spike setter, designed especially for use in advance of pneumatic cut-spike drivers, but equally adapted for setting spikes, regardless of how they may be driven down later. The new tool, which is designed to be handled by one man, consists essentially of a spike magazine, in the form of a hollow grooved casting, and a ram cylinder and a driving ram, together with such auxiliary parts as handles, a spike trip and a rail rest and guide.

The spike magazine and the ram cylinder are clamped together and are parallel with each other, except near the bottom of the tool where the magazine is curved inward and brought to a connection with the lower end of the ram cylinder, directly under

Two or Three Blows Sets the Spike About ¾ In.

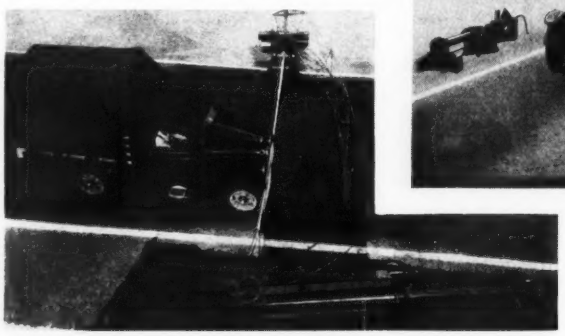
the blow of the ram. The magazine, which has capacity for 18 spikes, holds the spikes in a horizontal position by their heads and allows them to feed to the bottom of the tool by gravity. A trip near the bottom, operated by a hand lever near the top of the magazine, releases one spike at a time, which falls by gravity around the curving end of the magazine to a stop, directly under the driving head of the ram. When the spike has been lowered to this position, the tool, with the spike ready to be set, is raised to a vertical position, directly over the point where the

spike is to be driven, and the operator then sets the spike about ¾ in. into the tie by two or three blows with the ram. The ram itself is simply a steel rod, weighing about 18 lb., with a hardened steel driving head and a rubber grip. A coil spring surrounding the ram at the top of the ram cylinder cushions the blow of the ram and makes its operation easier on the operator.

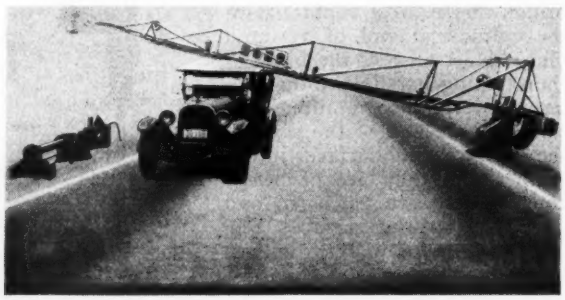
The spike setter itself weighs about 50 lb., and when loaded, weighs about 65 lb. It is slid along the rail from tie to tie, however, and does not have to be carried at any time during its operation. The rail-sliding arrangement on the tool consists of a pair of steel angles, provided with two adjustments, so that the tool can be adjusted for setting spikes for rail of different sections. It is said that the new tool will keep well ahead of a pneumatic cut-spike driver, relieving several men from the usual work of setting the spikes by hand.

Yielding Barrier Designed for Highway Crossings

THE Franklin Railway Supply Company, Inc., New York City, has developed and is manufacturing a new type of railroad crossing gate, known as the Highway Guardian, which is designed to provide a positive stop for highway vehicles at railroad crossings during the approach or passing of trains, without injury to the gate inself, the highway vehicle or its occupants. The fundamental feature of this gate or barrier is that it is of a yielding type, which will bring a vehicle to a gradual but positive stop, without effect on the occupants of the vehicle other than a sensation such as might be experienced by an unusually effective application of brakes. The reaction of the barrier, and therefore the sensation experienced by occupants of a vehicle striking it, is proportional to the force at which the barrier is struck, but it is said that even striking the barrier with an automobile at a speed as high as 40 miles an hour will not cause injury to the occupants of the car.



A truck just about to engage the barrier. Snubber is shown in the foreground



Five pounds pressure will stop the downward movement of the barrier

The Highway Guardian, which operates up and down across the highway, much the same as the single-arm crossing gate, consists essentially of a barrier cable carried across the highway by a barrier arm; a pedestal, which supports the pivoted end of the barrier arm and houses the mechanisms for its operation; and an hydraulic snubber device, over which the free end of the barrier arm locks when the arm is in a horizontal position across the highway.

The barrier arm, carrying the cable barrier, is a relatively light steel skeleton structure, one end of which is free, while the other is fixed to a pivoting base mounted on the pedestal. This arm, which is bowed outward toward the track, carries the cable barrier in a taut position from its pivoted end to its free end, in the form of a chord to the arm bow. The cable barrier itself consists merely of two strands of steel cable, brought together and covered by a canvas band. Connection of the cable to the free end of the barrier arm is over a steel ring, which, when the arm is in its lowered position, engages a post or hook on the operating mechanism of the snubber.

The pedestal carrying the barrier arm consists of a cast steel case, securely fixed to the foundation and is provided with housings on top for the ball trunion bearings on which the barrier arm operates. The interior of the pedestal is arranged to house the operating and control mechanism for the barrier.

The snubber device, through which the yielding feature of the barrier is provided, is located on the opposite side of the road from the pedestal carrying the barrier arm, and is essentially a hydraulically cushioned ram. This device consists mainly of a heavy steel frame mounted on a suitable foundation, and a crosshead connected through a piston rod to a hydraulic dash pot. The cross-head carries an engaging post, or hook, over which the ring at the outer end of the barrier arm fits when the arm is in its lowered position. This post is of such shape that the ring of the barrier arm locks under it when there is pressure on the barrier cable toward the track. As a car forces its way into the barrier, the snubber action comes into play and, owing to features of design of the snubber, the resistance set up by it is increased in proportion to the speed and weight of the vehicle striking the barrier. As the barrier is raised after being struck, pressure is again built up in the snubber cylinder, thereby returning the snubber crosshead and its engaging post to its normal position for further use when the barrier is again lowered.

The Highway Guardian can be arranged for manual, semi-automatic or automatic operation, the operating mechanism being more or less the same in each case and including a motor-driven hydraulic pump, a hydraulic cylinder and piston for raising the barrier arm, a magnet and pilot valve for controlling the pump motor, a hydraulic reservoir, a relief by-pass to control the pressure in the hydraulic cylinder, and such other equipment as electrical switches, signal relays, etc.

In its arrangement for automatic operation, the movement of the barrier is controlled through suitable track circuits, the gate lowering automatically

in response to a train entering or approaching a prescribed danger zone, and raising automatically when the train has left the danger zone. Several important features are incorporated in the design of the barrier to prevent damage or danger to vehicles, caused by the automatic operation of the barrier. In the first place, the barrier arm lowers itself gently, and it is said that the arm is so carefully balanced that a pressure of five pounds is sufficient to arrest its downward motion.

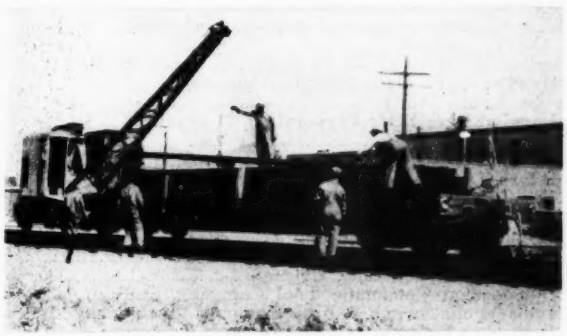
Owing to the pivoted connection of the arm at the pedestal, the barrier can be swung parallel with the road in either direction before it engages the snubbing device, which prevents damage to it or to a vehicle in the event that it is struck by a vehicle when being lowered. Further, it allows a vehicle caught on the tracks back of the lowering barrier, to push the barrier away from the track and thus escape from the danger area. In this latter case, the barrier can be swung in a horizontal plane away from the railroad track, even though it is in its locked position over the snubbing post for opposition to vehicles approaching the track, and will then return to its locked position.

Two red lights and a stop sign form regular equipment furnished with the barrier, but in addition to these, any combination of signals, audible or visible, can be installed in connection with the barrier.

Burro Cranes with Short Tail Swing

TWO NEW models of "Burro" cranes have been developed by the Cullen-Friestedt Company, Chicago, which have been designated as Models 20 and 30 and which have, as their important feature, an extremely short tail swing.

These cranes are each powered with a four-cylinder gasoline engine which is rated at 51 hp. at 1,100 r.p.m. and 60 hp. at 1,425 r.p.m. Model 20 weighs approximately 35,000 lb. and has a drawbar pull of 6,000 lb., while Model 30 weighs about 39,500 lb. and has a drawbar pull of 7,000 lb. Except for differences in capacities and weights, the two models are essentially the same in design and construction. The cranes are of the full-revolving type and the distance from the center of rotation to the rear of the cab is only 6 ft. 3 in., thus allowing the cranes to



A Burro Crane Handling Rail

be used to advantage in yards, terminals and other restricted quarters where it is necessary that traffic be unobstructed. With this short tail swing, a crane of either of these models may be turned at right angles to the track and still not foul a car which is standing on an adjoining track 12 ft. 6 in. away.

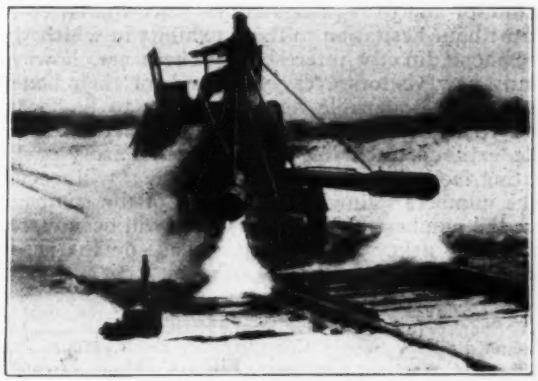
The booms of these cranes are of the box section type and the standard length is 33 ft., with a splice at the center so that sections can be inserted to increase the length. To elevate the base of the boom, two steel castings with elevated boom heels are bolted to the cast steel rotating deck. It is said that the elevated boom heels allow a shorter boom to be used than otherwise would be required when loading 39-ft. rails in a gondola.

Automatic all-steel couplers with spring draft gears are mounted on each end of the car body at the standard height to allow the crane to be coupled with railroad cars. Journal boxes are mounted on springs in the cast steel journal frames to allow the wheels sufficient vertical motion to remain on rough track when the crane is traveling at high speeds. The cranes will travel at speeds ranging from 1½ to 20 miles an hour under their own power. The over-all dimensions of the cranes are as follows: Height, 11 ft.; width, 8 ft. 1 in.; length, 16 ft. 3 in., and wheel base, 9 ft.

A Smaller Weed Burner

A WEED burner which has recently been placed on the market by the Woolery Machine Company, Minneapolis, Minn., has been designated as the Midget "Octopus," as it is the smallest of this company's line of railway weed burners. It is a two-burner machine and has been designed for use especially around yards and terminals and for short line railroads.

This machine is operated and handled by one operator and a helper. With both burners in operation, a strip



The Midget "Octopus" Weed-Burner in Operation

of ground 10 ft. wide is covered, while with the long arms in use, a width of 18 ft. is burned although, if required, special burner-heads can be furnished, which will throw flames out to a width of 25 to 30 ft. Each burner is under separate control and the fire is controlled by quick-action valves, thus eliminating the loss of fuel.

The machine is 20 ft. long, 6 ft. wide and 7 ft. 5 in. high, and the length of the burner tubes is 10 ft. It has a traveling speed of 20 miles an hour and a burning speed of from ½ to 15 miles an hour. The fuel used is kerosene, distillate, or light fuel oil with a specific gravity of not less than 25. The average fuel consumption is 10 gal. per mile for each burner head.

A TRAVELING BEACON—The Pennsylvania plans to equip a passenger locomotive with a headlight so adjusted that the rays will be projected perpendicularly for about 700 ft., and to operate it in Ohio to determine its usefulness in preventing grade crossing accidents.

N. R. A. A. to Hold Large Exhibit

Visitors to the Coliseum will find an interesting display of engineering and maintenance of way equipment

THE National Railway Appliances Association has completed plans for its twenty-second annual exhibition, which will be held at the Coliseum, Chicago, on March 10 to 13, inclusive, concurrently with the convention of the American Railway Engineering Association and the meeting of the Sigal Section of the A. R. A. As has been the custom in recent years, the exhibit will open Monday morning and close Thursday afternoon. It will be open from 8 a. m. to 6 p. m. every day, except Tuesday, when it will remain open until 10 p. m., and on Thursday the closing hour will be 3 p. m.

Most of the manufacturers who will display their products this year have been exhibitors in previous years and, as in the past, preference has been given to them in making the allotment of space, so that, in general, they will occupy the same spaces that they have occupied for a number of years. There is a mutual advantage in this arrangement to the exhibitor and to regular visitors, since the latter can go without hesitation to those exhibits in which they are most directly interested. There are, however, many new visitors every year, and for their benefit, as well as to enable new exhibitors to be located easily, there is presented here a complete record of the exhibits, including a list of the firms participating, together with the space they will occupy. The numbers following the names of the companies are the numbers of the booths they will occupy, thus providing a key for locating a space on the accompanying floor plan of the Coliseum.

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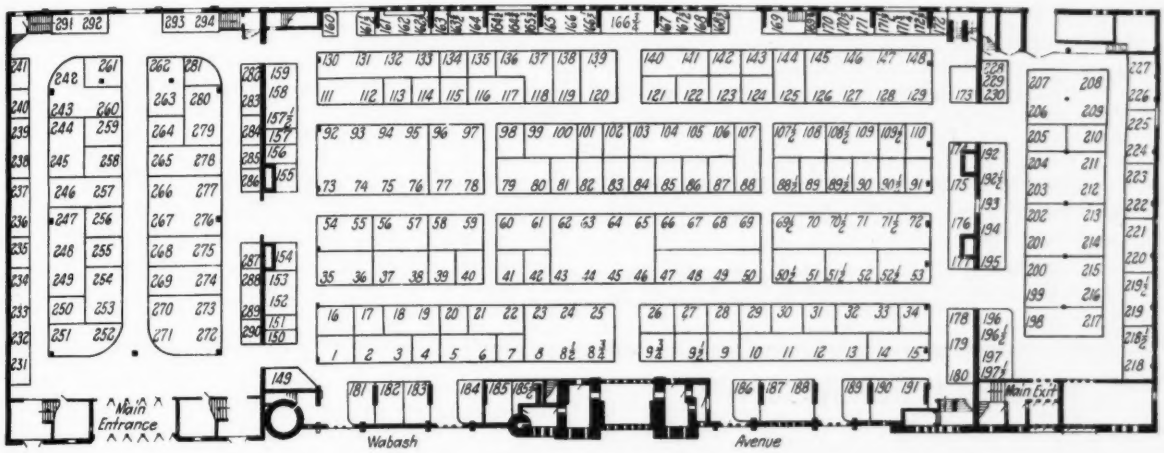

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A BAD SMASH.—A recent accident at Harlingen, Tex., indicates that it is much safer for railroaders to stick to the railroad. Walter E. Nixon, engineman for the Gulf Coast Lines, was killed there when the automobile he was driving was struck by another, driven by his own fireman, W. J. Lee.

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE MAY ISSUE

1. *When laying rail, what measures, if any, should be taken to avoid placing joints in highway or street crossings? By what means can this be done?*

2. *Should pipe culverts be installed on a straight line grade or should the grade line be arched? Why?*

3. *Where erosion from ditches or small streams threatens the stability of the roadbed, what methods of bank and channel protection are most practical or effective?*

4. *When ties show a tendency to split after they are inserted in the track, is it practicable to curb this tendency? If so, by what means?*

5. *When repainting a frame building, to what extent should the old paint be removed? How should this be done?*

6. *What are the relative advantages of Diesel and semi-Diesel engines for pumping water, and under what conditions should each be used?*

7. *When installing ties, should tie plates be applied before or after tamping? Why?*

8. *What is the most effective method of protecting treated piling from decay at the point of cut-off?*

Guard Rails on Curves

Under what conditions is it desirable to use guard rails on curves? Can the allowable speeds be increased on guarded curves?

Guard Rails Permit Higher Speeds

By H. M. CHURCH

General Supervisor of Bridges and Buildings, Chesapeake & Ohio, Richmond, Va.

Two distinct types of guard rails are used for the purpose of guarding curves. The first type is installed on bridges, in tunnels and alongside important structures, such as buildings, signal bridges, etc., to prevent or minimize damage after a derailment. This type is placed from 8 in. to 10 in. from the running rail, so that it is entirely free and independent of it and cannot function until after a derailment.

The second type, which is assumed to be the one referred to in the question, is so placed that it provides a flangeway to control the lateral movement of the wheels during their passage around the curves. When properly placed, these guard rails contact with the inside of the wheel flanges, thus preventing the wheels from exerting any pressures against the outside or high rail of the curve. In extreme cases they also prevent them from leaving their normal running position and tend to prevent derailments.

The use of guard rails is indicated wherever excessive wear occurs on the outer rail of the curve and, in some cases, where abnormal wear is found on the running surface of the low rail. They are very effective with respect to the wear of the outer rail, particularly if used in conjunction with rail-oiling devices. They also lessen the tendency towards corrugation, or washboard effect, and the flow of the metal on the running surface of the low rails on curves. In a number of instances which have come under the writer's observation, certain types of guard rails have also minimized the tendency of the rail to creep.

Guard rails have an economic value, therefore, since they extend the life of both rails and ties, while they frequently permit more superelevation, or a higher speed with the same superelevation, thus enabling faster schedules to be maintained.

Train Speeds Should Not Be Increased

By G. STAFFORD

Section Foreman, Canadian National, Rosebud, Alta.

Guard rails should be used in main tracks on sharp curves, and particularly where such curves reverse without the introduction of a short section of tangent. On reverse curves of greater radius, it is sometimes advisable to install a guard rail for some distance on each side of the point of the reverse, certainly to the point where full elevation is attained, in order to insure that the trucks will be properly straightened and the wheels brought to their normal running position.

Guard rails should also be placed on sharp curves on wye tracks, industrial spurs and other slow speed tracks, to insure that locomotive driving wheels will be held in proper relation to the running rails. On such tracks, as an additional precaution, it is wise to use a guard rail that is about 1 in. higher than the running rail.

In my opinion, it is not good practice to increase train speeds around guarded curves. The speed should be confined to that established by accepted rules covering the relation of speed, superelevation

and curvature, without reference to the guard rails, which are simply an added precaution to increase the margin of safety. There is a maximum safe speed for any given combination of superelevation and curvature and, while the guard rail does control the action of the wheels and reduces the wheel pressure against the outer rail, the same centrifugal forces are present, regardless of whether the curve is guarded.

The need of guard rails may also be indicated when excessive rail wear is observed on curves, where the question of train speed is not important. In general, however, although the reduction of rail wear is important and cannot be ignored in deciding whether a curve should be guarded, this consideration is secondary to the main purpose of the installation, which is to increase the margin of safety.

Preparing Culverts for Spring

What precautions can be taken during the winter to insure that culverts will offer free passage for melting snow in spring thaws?

Clear Channels Insure Free Passage of Water

By H. M. Church
General Supervisor Bridges and Buildings, Chesapeake & Ohio, Richmond, Va.

There are no precautions which are superior to the continued maintenance of well cleaned side ditches, channel approaches and outlets to all culverts. Proper attention to this important feature of roadway maintenance requires that, at the approach of winter, all channels should be well cleaned and free from all forms of obstruction; that the culverts themselves should be cleaned; and that drift or other debris, which may wash down under flood conditions, has been removed, provided it is under the control of the section or bridge forces.

The roadway slopes at culverts should be adequate, and the embankments should not run over into the channel. The channel should be as straight as possible and the slope, if not stable, should be widened as much as practicable. All boulders should be removed from the channel, and sand and gravel bottoms smoothed up.

If this work has been done properly, the winter work will consist merely in removing accumulations of snow and ice and the maintenance of smooth channels of such a character as will reduce the coefficient of friction to a minimum, and give the freest passage to the water from the melting snow, which may be augmented by the run-off from heavy rains.

Waterways Should Be Cleaned

By E. R. Lewis
Principal Assistant Engineer, Michigan Central, Detroit, Mich.

The winter preparation for spring floods, which occur as a result of melting snow, is to clear the inlets and outlets of open ditches and underground drains, and to examine the waterways beneath embankments for obstructions which should be removed as required. There are cases where machine shoveling is of advantage. Special conditions are sometimes found, which make it desirable to ice the slopes of snow trenches by applying water to make them stand. In other cases it may be advantageous to tunnel the inlets and outlets of ditches and culverts rather than to dig trenches, thus eliminating the danger that snow from subsequent storms will drift in and again fill the waterways. It is usually advantageous to clear a considerable space about the inlet of the culvert, in order to provide ample room for some accumulation of water, particularly where the grade approaching the culvert is steep and the drain is likely to prove too small to permit the immediate passage of all the water in case of a sudden thaw. In addition to these precautions, the preparation for roadbed repairs, in anticipation of flood conditions, should include cars of material under load, if feasible, or stocks of bank-protection materials ready to be loaded quickly in case of emergency.

A valuable asset is a well considered program of action, which includes a systematic inspection of conditions, instructions to foremen and special daily attention to section patrol, with a view to preventing flood damage to the property. Every flood is a lesson; every trackman is remiss who does not heed the warning to remedy flood conditions to the best of his ability during the winter months.

No railroad is properly built unless and until the roadbed generally is on embankment. This means that the cuts must be at least as wide as a ditching machine, operated from a flat car, can reach. The depression made by the ditcher should then be deepened into surface ditches, located as far from the center line of the track as is feasible, and turned away from the track at the outlet. Such improvements are made, preferably, in early summer, in preparation for bank widening, reballasting or resurfacing. There is nothing in maintenance which returns so great a profit as the improvement of drainage.

Split-Head or Piped Rail?

In what way does a split-head rail differ from a piped rail? What are the indications of each?

Piped Rails Seldom Fail

By C. B. Bronson
Assistant Inspecting Engineer, New York Central, New York

The most widely misused term in connection with defective rails, removed from service is the term "piped rail." Despite the fact that the understanding of rail service and rail manufacture is greater today than ever before, this term continues to be misapplied.

A rail seldom fails in service because of a pipe. Split-head failures, on the contrary, are numerous. Yet many roads continue to report "piped rail" as the cause for the removal of the greatest number of rails on their lines. As a result of a number of years of experience in inspecting rails, in which he has examined many hundreds of such rails, the writer can vouch for the statement that practically all such rails fail from split heads.

The term "pipe" should be confined strictly to mill and metallurgical phraseology. A pipe is the natural and inevitable shrinkage cavity in the interior of the ingot, developed during the cooling process. Its size can be controlled to some extent by adjustment of the chemical elements, shape of ingot, methods of cooling and by details of charging and reheating in the soaking pits.

The pipe is always located in the web, usually up to and a little beyond the fillet joining the head, but rarely extends upward for any distance into the head. The metal in the head above the pipe is quite sound and free from segregation. Metal of this character is far less susceptible to flow, crushing or splitting than segregated metal.

True piped rails have been removed from service,

but the pipe has not been found as the primary cause for the removal of defective or fractured rails, as this is only a secondary or incidental cause. When pipes are disclosed in such rails, the outstanding characteristic is the unwelded surface through the web of the rail, often with indications of slag, unless the surfaces are oxidized.

Split-head rails are far more troublesome. Failure invariably occurs in segregated metals, dirty steel, or green or improperly set ingots. Conditions such as these are conducive to the breakdown of the head structure.

The formation of the split head results from the wedging action of the surface metal just below the top of the rail, which acts like a chisel point pounded into the segregated metal directly below, by the action of the wheel loads as they pass over the rail. An incipient fracture having formed, a gradual growth follows. The split deepens and travels lengthwise of the rail. If the rail is not removed, the fracture may extend many inches or feet along the interior of the rail.

There is ample evidence on the exterior of the rail head to warn of the development of split fractures. The head widens out, and a hollow place appears on the top or running surface of the rail, so that a dark streak can be seen near the center of the head where the wheel treads no longer come in contact with the rail surface, directly above the point where the split fracture is developing. In its advanced stage, the split finally works to the surface at the junction of the head and web and is positive proof that the rail has a split head and should be removed immediately. Thus, ample warning is always available to permit the removal of such rails before final failure.

The confusion which exists with respect to the term "piped" and its misuse, probably results from the fact that the smooth surfaces on the adjacent faces of a split-head fracture resemble the surfaces of the metal at a pipe. Split heads, however, always start from a zone close to the top surface of the rail head and develop downward. On the other hand, the chances for the enlargement or extension of a pipe in the web of the rail, either upward or downward, are remote.

Each Have Distinct Characteristics

By H. H. Morgan
Manager, Rail and Fastenings Department,
Robert W. Hunt Company, Chicago

In the days when Bessemer rail was in common use, it was customary to apply the term "piped rail" indiscriminately to both true piped and split-head rails. Recently, this term has been more properly used, however, to indicate the unwelded shrinkage cavity which occurs near the top of the ingot and which is rolled closed into the rail section. This cavity exists, generally, only in the web of the rail, and usually is confined to the "A" rails which are rolled from the top of the ingot.

A split-head rail is a rail in which the side of the head splits off, usually on the gage side, under the action of the wheels. Splits may or may not occur in segregated or unsound material, but they usually have no connection with pipes. This form of failure is the result of a shear, which originates in the less sound and more segregated metal represented, usually, in the "A" or top rails of the ingot. While it generally occurs in the form of a vertical split, horizontal splits are not uncommon, though not as frequent, and result from the same causes.

The indication of a split-head or piped rail, before it reaches the surface and causes a complete failure, is a longitudinal black streak on the running surface. This is caused by the depression of the metal immediately above the internal sheared area, which has lost contact with the running surface of the wheel. At the beginning, a pipe is merely a closed cavity which has been pressed into a plane of cleavage of limited extent by the action of the roll. Pipes generally remain dormant, but in some instances fractures start from the piped areas and progress very much in the same manner as split heads and give the same indication on the top surface of the head.

In the later stages, the split-head fracture usually reaches the surface at or near the fillet between the head and web, showing first as a fine streak of fresh rust. In general, from this time the fracture extends along this surface rapidly, and the rail may fail at any moment during the passing of a train. The fractures which originate in a pipe, act in a similar manner, except that they appear suddenly at a point on the surface of the web about half way between the head and the base of the rail. In both types of fracture the dark streak and failure of the rail are accompanied by a spreading or widening of the head.

Attaching Stringers to Caps

Where treated timber is used in wooden trestles, is it permissible to use drift bolts for attaching the stringers to the caps? If not, how should this be done?

The Use of Drift Bolts is Desirable

By E. A. Frink
Principal Assistant Engineer, Seaboard Air Line, Savannah, Ga.

It is our practice to build all of our ballast deck trestles of treated timber. The floor is made of treated stringers packed solid the full width of the trestle, and, in such cases, we do not drift bolt all stringers, but only a sufficient number, principally on the outside of the trestle, to hold the deck and bents in place. It is not only permissible but desirable to use drift bolts, driving them through the stringers into the caps, as there is no other more satisfactory way, so far as I know, of connecting the two. Lugs bolted to the sides of the caps have been used, but I consider these more objectionable than drift bolts, as the holes through the sides of the stringers are more accessible to moisture.

For open deck trestles, we often use untreated cypress caps, and in that case we drift all stringers. It is our invariable practice, however, to pour hot creosote into the drift-bolt holes of both ballast-deck and open-deck trestles, the result being that when the drift bolt is driven, the creosote is forced into the wood. With this precaution, and through the use of tight-fitting bolts, there is little, if any, chance for moisture to enter the holes. We have been following this practice for many years and, so far, have not had an instance of decay around drift bolt holes requiring the removal of timber.

Drift Bolts Should Not Be Used

By L. G. Byrd
Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

The use of drift bolts should not be permitted for attaching stringers to caps, as this method breaks the fibres of the treated timbers and allows water to penetrate around the drift bolt, thus causing decay.

Stringers should be attached to caps with angle-iron straps which are fastened to the packing bolts in the stringers and bolted to the caps. The holes for the necessary bolts should be bored, and all necessary framing of the timbers should be done before treatment. This method is being followed as a regular practice on the Missouri Pacific for attaching stringers to caps in open deck trestles, ranging from 24 ft. to 1,380 ft. in length, with satisfactory results. The preframing of trestle timber before treatment includes caps, ties and guard rails as well as stringers.

Desirable Heads for Water Columns

What are the desirable maximum and minimum heads for water columns, from the standpoints of efficiency and maintenance? How are these affected by the relative positions of the tank and water columns?

About 45 Ft. Gives the Best Results

By J. R. Hickox

Hydraulic Engineer, Chicago, Burlington & Quincy, Chicago

Our experience has been that a head of about 45 ft. gives us the most desirable results. But along with this, we must have a pipe of sufficient capacity, so that the friction in the pipe line will not reduce the head too much at the crane. Our practice, wherever possible, has been to use a 12-in. or 14-in. pipe in the supply line which serves the water column. Under these conditions, if the head is in excess of 45 ft., the velocity of the water, as it discharges from the water column, becomes too high, while, if it is less than 30 ft., the rate of flow is so low as to be unsatisfactory. Every case should be handled as an independent problem, however, taking into account the length and size of the line connecting the crane with the tank. In designing the layout, this supply line should be made as short as consistent with the local requirements, in order to reduce the possibility of water hammer to a minimum.

Velocity in Supply Main Determines Head

By C. R. Knowles

Superintendent Water Service, Illinois Central, Chicago

It is difficult to establish definite limits as to the maximum and minimum heads for water columns that will apply to all conditions, since so many factors are involved, including the rate of delivery required, size, length and condition of the supply line and the height of the discharge outlet of the water column.

The controlling factor for determining the proper head for a given condition, however, is the velocity of flow in the supply main. In a test of water columns, made at the University of Illinois some years ago, the maximum allowable velocity for long water column mains was placed as low as 8 ft. per sec., and the limit of the desirable flow through the water column itself, was placed at 3,000 g.p.m., for an 8-in. water column; 4,000 g.p.m., for a 10-in. water column; and 6,000 g.p.m., for a 12-in. water column.

The amount of water discharged through the water columns in these tests was higher than is practical in ordinary service and represents the flow through short pipe lines. The velocity of flow through pipe lines in an ordinary distribution system is usually around 5 ft. per sec. and is sometimes as low as 3 ft., depending upon economic considerations. A maximum velocity of 12 ft. per sec., however, may be arbitrarily fixed for water columns, although, under certain conditions, in extremely short lines, 15 ft. per sec. may not be objectionable. For long lines, 300 ft. and over, however, the velocity under no circumstances should exceed 10 ft. per sec. and preferably not more than 8 ft.

The American Railway Engineering Association specifications for towers for wooden water tanks show standard heights of 16 ft., 20 ft., and 30 ft. above the rail, or a maximum overall height of 50 ft. The 16-ft. tower is designed for use where delivery is made direct from the tank through a tank spout, and is not suitable where water columns are used. A tank with an overall height of 50 ft. above the rail, serving a water column having a discharge outlet 15 ft. above the rail, would have a maximum head of 35 ft. above the point of discharge. Assuming that the water column was served by 300 ft. of 12-in. supply main, the discharge would be approximately 4,300 gal. with the tank full, which gives a velocity of 11.9 ft. per sec. With only 1 ft. of water in the tank, the discharge would be 2,750 gal. and the velocity 7.8 ft. per sec. A tank 20 ft. high at the bottom, and 40 ft. overall above the rail, with the same water column and pipe line, would deliver 3,600 g.p.m. with the tank filled, and 1,550 g.p.m. with one foot of water in the tank, the velocity through the 12-in. pipe, for the higher discharge being 10 ft. per sec. Increasing the diameter of the pipe from 12 in. to 14 in. would increase the discharge, with the tank full, to 4,500 g.p.m. and reduce the velocity to 9.5 ft. per sec.

The height of tanks and towers, as fixed by the A. R. E. A. standards, would appear to establish the proper heads, as water columns are operating satisfactorily under these conditions. However, where relatively high velocities are maintained through pipe lines, it is necessary that the closure of the water column valves shall be properly controlled, in order to avoid damage through water hammer.

Supporting Steel Spans

Under what conditions is it permissible to support a steel span on pile piers?

Unstable Bank Conditions Call for Pile Piers

By J. E. Bernhardt

Bridge Engineer, Chicago & Eastern Illinois, Chicago

In my opinion, the most important condition under which it is desirable to use a pile pier is where the subsoil conditions are such that the embankment adjacent to the end of the bridge is likely to be unstable. Where this condition occurs, the span can be supported on pile piers, and the approaches made of timber trestles, until such time as the embankment has reached a state of equilibrium and it is probable that it will remain stable. A somewhat similar condition, under which the use of pile piers is sometimes advisable, occurs in the crossing of a new drainage ditch, where the ultimate size of the ditch is not known at the time the ditch is constructed. It is our experience that drainage ditches frequently erode in such a way that the width may be increased materially. If pile piers are used, we are not subject to a heavy loss if it is found later that it is necessary to increase the length of the span as a result of this erosion.

Pile piers may also be used with economy on unimportant branch lines, or for steel spans on side tracks which may be abandoned after a comparatively few years of service. The same consideration

applies on those parts of a main line which may be affected in a short time by grade revision or changes in alinement.

It sometimes becomes necessary to install a steel span for the purpose of replacing a pile trestle, in which new creosoted piling has been driven. If some of the existing pile bents can be used to support the span, this should be done in the interest of economy, since the cost of providing supports for the new structure can be reduced materially in this way.

Should Be Used Where Changes Are in Prospect

By L. B. Curtiss

Assistant Engineer, Northern Pacific, Seattle, Wash.

The inability to foresee future conditions has resulted in the placing of many steel bridges on permanent piers, where later developments have shown that it would have been much more economical to have used timber piers. I have in mind a case in point, where a steel span was placed on pile piers over a waterway, from which the water has now been diverted to another channel. As the larger opening is not now needed, the steel bridge is to be replaced with a pile trestle, and the loss incident to abandoning the old timber piers is very small compared with what it would have been for permanent construction.

On branch-line construction, where the first cost frequently is important, pile piers may be used to advantage. Later, when they require renewal, permanent piers can be built in line with the temporary piers, and the steel spans shifted longitudinally to their final location, without the necessity of providing falsework.

In some instances, when steel spans are removed from main lines and re-erected on branch lines, pile piers may be used with economy, since the life of the timber, if treated, may nearly equal the remaining service life of the steel.

In general, where there is a probability of later channel changes, the diversion of all or part of the water in an existing channel, a revision of alinement or of grade or any other condition that would affect the type of the bridge best suited for a particular location, it is better to place the steel span on pile piers until such time as the requirements can be determined with greater accuracy.

Protecting Joint Ties

What methods can be used to protect joint ties from the effect of creeping rail?

Stop the Rail From Creeping

By E. P. Safford

Supervisor of Track, New York Central, Silver Creek, N. Y.

The most effective method of protecting joint ties from the effect of creeping rail is to stop the rail from creeping. The most practical way to overcome the tendency of the rail to creep is to apply a sufficient number of anti-creepers, evenly distributed throughout the rail length.

Every railway has a definite standard of track construction which specifies the number of ties which are to be applied to the various lengths of rail that may be in service. When anti-creepers are to be applied, the local maintenance officers should decide on the number of rail anchors which are required for each length of rail, and the foreman should then be provided with a sketch of each mile on his section, upon which is shown the number and distribution of anti-creepers to the rail. The supervisor should satisfy himself that they have been properly applied.

It is usually of prime importance that this application be made as soon as the rail is laid, to insure that the provision for uniform expansion is maintained. If the policy of the road requires that the ties shall be spaced, it may be necessary to remove the anti-creepers and reapply them when the spacing is done later. For this reason, it is desirable to use anti-creepers that can be removed and reapplied. Whatever the method, however, the proper anchorage of track requires eternal vigilance on the part of both the foremen and the supervisory officers.

The application of anti-creepers, uniformly spaced throughout the rail length, was criticized on the floor of the recent Roadmasters' convention, on the ground that such a distribution may bring some of the anchors against defective ties. It is the opinion of the writer, however, that this position is not tenable, since ties which are not in sufficiently good condition to support the pressure of the rail anchor should not be in the track.

In properly anchored track, the necessity of slot spiking at the joints is eliminated, so that if there should be some slight movement of the rail, the ties will neither be damaged nor shoved off of their tamped beds, and they will function properly to provide adequate support for the rail.

Avoid Slot Spiking

By G. W. Evans

Section Foreman, Missouri-Kansas-Texas, Elgin, Texas

Since the greatest damage to joint ties, as a result of creeping rails, comes from slot spiking the joints, this practice should be eliminated. If joint tie plates are used, they should be of such a pattern as will not permit slot spiking.

It is fundamental that the best way to overcome a bad effect is to eliminate the cause. The most practical way to protect joint ties from this type of damage, therefore, is to anchor the track so as to prevent the rail from creeping.

Owing to the fact that a large part of the rail movement which is called creeping is caused by temperature changes, much can be done to prevent damage to joint ties by proper attention to expansion at the rail joints. In my experience I have found that proper lubrication of the rail joints gives very satisfactory results. If ordinary fuel oil is applied by means of a grease gun or oil pump, either of which costs about $1.60, the lubrication is sufficient to permit movement of the rail in the joint fastenings during temperature changes. One man working eight hours can lubricate all of the joints on a mile of track. If applications are made at intervals of about six months, and proper attention is given to the tension of the bolts, much of the trouble from creeping will be eliminated and "frozen joints" will give little or no trouble.

Anchor Single Track in Both Directions

By W. E. Counts

Division Roadmaster, St. Louis-San Francisco, Newburg, Mo.

My opinion, based on 34 years' experience in track work, is that the only way to protect joint ties against the form of damage implied by the question is to go back to the primary cause and stop the rail from creeping. With the present type of track construction, this can be done only by a proper application of anti-creepers. Since the two rails on a

single track tend to creep in opposite directions it becomes necessary to anchor the track in both directions. I have tried this system with excellent results on tracks that formerly gave an unusual amount of trouble. If the track is properly anchored, slot spiking is unnecessary, which, in my opinion, is a still further benefit.

A Full Ballast Section Helps

By F. A. Mears

Section Foreman, Missouri-Kansas-Texas, San Antonio, Texas

In addition to the damage which creeping rail does to the joint ties themselves, the ties are carried off their bed and slued across the track, thus affecting both the gage and surface at the joints, besides giving a poor appearance to the track. These conditions can be minimized, if not wholly corrected, by double spiking the joints and applying a sufficient number of rail anchors to the remainder of the rail. It is necessary, in anchoring track, however, to have a full ballast section, so that the spaces between the ties are filled with well compacted ballast.

Use Anti-Creepers Opposite the Joints

By John C. Caragan

Section Foreman, Minneapolis, St. Paul & Sault Ste. Marie, Frederic, Wis.

The most satisfactory method of protecting joint ties against damage caused by creeping rail is to apply four anti-creepers to the rail, opposite the joints (which are slot spiked), one on each side of each joint tie, thus anchoring the rail in both directions. It is understood, of course, that sufficient additional anti-creepers must also be used to overcome fully the tendency of the rail to creep. By following this practice consistently I have not had a slued or damaged joint tie for three years.

Advantages of Assigning Bridge and Building Work to Same Gang

What are the relative advantages and disadvantages of assigning both bridge and building work to the same gang?

The Work Should Be Segregated

By L. G. Byrd

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

In my experience I have found that there is a marked disadvantage in assigning both bridge and building work to the same gang. The first and most important consideration is safety. A gang which has been assigned to building work for a month or more, requires reorganization when returned to bridge work, since there is a greater hazard connected with bridge than with building work, although the men employed in both are required to know how to carry out both types of maintenance. In my opinion, there is a definite economy in assigning building work to one gang, ordinary bridge work to another and pile driving to a third. Where the men are engaged permanently in a definite class of work, they learn the safe way of handling that work, and understand more clearly the hazards which are attached to it.

It is my custom to carry this method of organization on down through the gang, assigning to each employee the class of work with which he is most familiar, is best qualified to do or prefers doing. In this way each member of the gang is a specialist and, if he enjoys the class of work to which he is assigned, he soon becomes expert in that assignment. It is not possible to secure the best results from a dissatisfied employee. If he does not like the work he is doing he will take no interest in it.

Proper plans or methods of working to the best advantage in these three classes of work, cannot be made or carried out if the gangs are shifted from one class to another. It is usually quite difficult to persuade building carpenters, who have the ability to do finishing work, to engage in bridge work. Similarly, bridge carpenters are reluctant to undertake building work, while many of them do not have the proper tools for it. Furthermore, the assignment of both classes of work to a single gang frequently requires that a large amount of heavy equipment shall lie idle while the building work is being performed. As a rule, bridge work is of such a character that a large part of the forces engaged in it can be composed of laborers and helpers. On the other hand, building work usually requires that practically the entire force shall be experienced carpenters, many of them skilled in finishing.

Such an Assignment Promotes Economy

By E. C. Neville

Master of Bridges and Buildings, Canadian National, Toronto, Ont.

It is assumed that the question has reference to maintenance work. There is a definite advantage in being able to assign both bridge and building work to the same gang, since it permits the programming of the work, so that one gang can clean up all of the work on a given territory as it goes along. This eliminates the extra expense of having to move two separate gangs and their outfits over the same territory. Considerable time frequently is lost in moving a gang from one point to another and the duplication of such movements creates an added expense for which the railway receives no return.

The larger part of building maintenance consists of repairing roofs and floors in freight-houses and sheds, platforms, docks, roundhouse doors, engine pits and many other classes of work which do not require the skill that is necessary for many forms of interior building work. For this reason, this class of work can be done as well and as economically by a bridge gang as by a building gang.

A particular advantage of assigning both classes of work to the same gang is that it permits the allotment of certain territories to a regularly assigned gang, which can then handle all of the work on this territory in accordance with a program prepared in advance. Where there is any amount of repair work that requires more skilled workmen, three or four such men can be added to the gang and placed under the supervision of an assistant foreman.

This system of assigning work aids in the stabilization of forces and creates a feeling of greater security among the men, a much desired condition in connection with the economical performance of maintenance work.

A great deal, however, depends on the foreman. A well qualified bridge and building foreman, who has come up through the ranks, usually has a good knowledge of all classes of work in connection with both bridges and buildings. If he is alert and interested in his work, he will soon have his men trained in both branches. Such qualifications should be given particular attention when choosing men for the position of foreman.

WITH THE ASSOCIATIONS

American Railway Engineering Association

Final details of the thirty-first annual convention of the American Railway Engineering Association have been virtually completed and a record attendance is expected. The program for the convention, which will be held at the Palmer House, Chicago, on March 11 to 13, inclusive, is as follows:

First Day—Tuesday, March 11

President's address, by Louis Yager.
Reports of the secretary and treasurer.
Reports of committees on:
- Standardization.
- Water Service and Sanitation.
- Uniform General Contract Forms.
- Stresses in Track.
- Rules and Organization.
- Roadway.

Second Day—Wednesday, March 12

Reports of committees on:
- Ballast.
- Wood Preservation.
- Signals and Interlocking.
- Ties.
- Track.
- Yards and Terminals.
- Shops and Locomotive Terminals.
- Iron and Steel Structures.
- Clearances.
- Rail.
- Masonry.

Third Day—Thursday, March 13

Reports of committees on:
- Wooden Bridges and Trestles.
- Buildings.
- Records and Accounts.
- Electricity.
- Economics of Railway Labor.
- Economics of Railway Operation.
- Economics of Railway Location.
- Rivers and Harbors.
- Co-operative Relations with Universities.

In addition to the program for the days' sessions given above, the annual dinner will be held as usual on Wednesday evening of the convention week. There will be two principal speakers, one of whom will be Charles Donnelly, president of the Northern Pacific. A special program has also been arranged for Tuesday evening which will consist essentially of a review of the association's representation at the World Engineering Congress held last fall at Tokyo, Japan. This will include a showing of moving pictures featuring the congress, in addition to a film furnished by the Japanese National Railways which will depict railway practices in Japan.

The offices of the secretary of the American Railway Engineering Association, which for a number of years have been consolidated with the offices of the American Railway Association at 431 South Dearborn street, Chicago, will be moved on April 1 to the Buckingham building, Van Buren street between Wabash avenue and Michigan avenue.

Roadmasters Association

The executive committee and the chairmen of committees will meet at the Hotel Stevens, Chicago, at 6:00 p. m. on Tuesday evening, March 11, for dinner and conference on association activities. In addition to transacting such business as may properly come before such a meeting, the chairmen of committees will present tentative reports for review by the executive committee.

The Bridge and Building Association

The officers, chairman and members of committees and other members of the association who will be in Chicago during the convention of the American Railway Engineering Association will meet at lunch at the Palmer House at 12:15, Wednesday, March 12, to discuss the affairs of the association and consider ways of promoting its interests.

Wood-Preservers' Association

Immediately following the adjournment of the recent annual convention at Seattle on January 30, the executive committee met with the chairmen of the last year's committees to perfect the committee organization for the new year. At that time the assignment of subjects and the personnel were determined and the members have since been advised of their appointment.

The executive committee will hold its next meeting in the Palmer House, Chicago, on Wednesday, March 12.

Metropolitan Track Supervisors

The Metropolitan Track Supervisors' Club of New York held its monthly meeting for February at Keen's Chop House with 44 members and guests present. At that meeting a paper was presented on the subject, "Are Trackwalkers a Present Day Necessity?" The club will hold its next meeting at the same place at 6:30 p. m., April 10.

Maintenance of Way Club of Chicago

At a meeting of the club held on Wednesday evening, February 19, D. C. Curtis, chief purchasing officer of the Chicago, Milwaukee, St. Paul & Pacific, read a paper on material supplies and the recovery of scrap as affecting the maintenance of way department. The attendance was 102.

The Railway Industry at a Glance

Operating revenues and expenses of the Class I steam railways in the United States, from data compiled by the Bureau of Statistics, Interstate Commerce Commission

	Month of December					
	1929	1928	Decrease 1929 Under 1928, per cent	1929	1928	Increase 1929 Over 1928 per cent
Total operating revenues	$468,878,960	$496,766,123	5.6	$6,352,354,833	$6,189,917,189	2.6
Expenditure for maintenance of way and structures	**60,063,355**	**61,567,560**	**2.4**	**862,701,113**	**848,313,029**	**1.7**
Total operating expenses	362,814,313	358,323,819	1.3*	4,553,968,834	4,482,041,316	1.2
Net railway operating income	72,227,197	94,691,336	23.7	1,274,774,189	1,194,487,806	6.7

*Increase

RAILWAY NEWS BRIEFLY TOLD

Appropriations amounting to $8,322,650 for the work of the Interstate Commerce Commission in the fiscal year ending June 30, 1931, were passed by the House of Representatives on February 15. This is an increase of $773,825 as compared with the appropriations for 1930, but is $1,007,313 less than the budget estimate for 1931.

President Hoover on February 8 sent to the Senate the nomination of Hugh McCall Tate, a lawyer of Knoxville, Tenn., as a member of the Interstate Commerce Commission to succeed R. V. Taylor, whose term expired at the end of 1929. The appointment of Mr. Tate was approved by the Senate committee on interstate commerce on February 11.

The management of the Pennsylvania has announced that on January 1, a record number of individual shareholders was reached, 196,119 being listed as owners of the property. This was the fourth month in which ownership has risen to record-breaking totals for wide-spread distribution. A large proportion of the increase is accounted for by the addition of many employee stockholders.

The preliminary statement of the Interstate Commerce Commission of the number of railway employees as of the middle of December, 1929, showed an increase of 0.28 per cent in the maintenance of way and structures group over that for the corresponding period in 1928. The statement gave 1,605,083, as the total number of employees, a decrease of only 1.04 per cent as compared with December, 1928.

The Supreme Court of Ohio has sustained an order issued by the Public Utilities Commission of that state directing the New York Central, in using a locomotive crane for switching service, to man the locomotive with a full crew. The Ohio statute states that a switching engine must have an engineman, a fireman, a conductor and at least two helpers. The full-crew law being accepted as constitutional, the only question was whether the locomotive crane should be called a locomotive, and the court decided that it should.

An investigation by the Committee on Interstate and Foreign Commerce of the House of Representatives into the ownership of railroad interests by holding companies, investment trusts, etc., and as to the ownership of the holding companies and others, was authorized by the House on January 24. An expenditure of not to exceed $25,000, for the purpose of financing this investigation, was authorized by a resolution which was adopted by the House on February 1.

The entire ownership of the Sand Springs Railway, operating between Sand Springs, Okla., and Tulsa, a distance of 10 miles, is vested in the Sand Springs home for orphans. This road is believed to be the only common carrier engaged in interstate traffic, which devotes its entire net income to the maintenance of a philanthropic institution. The company was organized in January, 1911, by Charles Page, Oklahoma capitalist, who founded the Sand Springs home in 1908, and endowed it entirely from his own resources.

Seventy troops of boy scouts have been organized during the last few years by the Chicago, Milwaukee, St. Paul & Pacific, through a special department, established for this purpose, working in conjunction with local organizations of boy scouts. This road has more than 30,000 employees in some 1,500 communities and it must draw on the youth of these communities to maintain its personnel. It has been found that lads who have been trained as boy scouts, make courteous and dependable employees and, in addition, are trained to avoid accidents to themselves and others.

Reciprocal Buying

The Federal Trade Commission opened an investigation of "reciprocal buying" by the railways from companies affiliated directly or indirectly with large shippers, at Chicago on February 17, on a complaint that the railways were "induced and compelled" to purchase draft gears and other equipment sold by the Mechanical Manufacturing Company (a majority of whose stock is owned by officers of Swift & Company or by members of the Swift family) by promises of traffic from Swift & Company or by threats of its withdrawal. At these hearings numerous letters were introduced from the files of railways, addressed to traffic officers of these roads by R. O'Hara, traffic manager, and other officers of Swift & Company, disclosing the interest of officers of this company in the Mechanical Manufacturing Company and suggesting reciprocity in business. Traffic and purchasing officers of these roads also testified to overtures for use of the gear being made first through the traffic department.

The Secretary of War has accepted an arrangement with the government of Nicaragua, whereby the battalion of the United States Army engineers now engaged in making a survey of a route for a canal through Nicaragua, will, in addition, survey for a railroad from Lake Nicaragua to the Atlantic coast, via the San Juan River valley. This survey when completed will be made available to the government of Nicaragua. In return, the government of Nicaragua will furnish free transportation of men and supplies on the railroad and lake steamers belonging to the Pacific Railroad of Nicaragua.

According to C. C. Cook, maintenance engineer of the Baltimore & Ohio, the railroads of this country save $145,000 a day by their present practice of using chemically treated timber for crossties and other purposes. He states further that, since 1909, the consumption of treated wood in this country has increased from 75 million to 336 million cubic feet and that, at the present time, the railroads use three-fourths of this quantity, largely for ties. He predicts that the average life of ties will soon be more than 20 years and that, when this becomes true, the railroads will save $287,000 a day.

The Interstate Commerce Commission on February 10 indicated that it is now in a position for the first time since the transportation act of 1920, to receive and act upon applications for approval and authorization of actual consolidations of railway properties under paragraph 6 of section 5 of the act, as distinguished from acquisitions of control by stock ownership, lease, or other methods not involving complete consolidation, such as it has been passing on for several years under paragraph 2 of section 5. The commission has also indicated, however, that it will still deal with applications for acquisitions of control filed under paragraph 2, whether or not they are in accordance with the complete consolidation plan issued last December, if terms and conditions are stated on which the commission may act, although plans for complete consolidation must be in harmony with the plan or be accompanied by motions for its modification.

Construction News

The Atchison, Topeka & Santa Fe has received permission from the War Department for the construction of a bridge over the Illinois river near Chillicothe, Ill.

The Canadian National is preparing plans, in co-operation with the city authorities of London, Ont., for the construction of a new passenger station and office building, to cost between $700,000 and $1,000,000, and for the elimination of six grade crossings in that city, at a probable cost of $3,750,000.

The Chicago & North Western, has awarded a contract to the John Griffith & Son Company, Chicago, for the construction of reinforced concrete platforms and other freight-handling facilities for an inbound and outbound freight station on the ground floor of the Merchandise Mart at Chicago, at a cost of about $650,000.

The Chicago, Rock Island & Pacific has received the approval of the War Department for the reconstruction of its bridge over the Des Plaines river and the Illinois and Michigan canal at Joliet, Ill. This company closed bids on February 20 for the grading for the construction of a single track line between Dalhart, Tex., and Morse, 65 miles.

This company and the Chicago, Rock Island & Gulf have jointly applied to the Interstate Commerce Commission for authority to build a line from Forrest, N. M., to Vega, Tex., a total of 76 miles. The Rock Island proposes to build from Forrest to a point in the southwest corner of Deaf Smith county, Tex., and the Gulf from that point to Vega.

The Erie has been directed by the Public Service Commission of New York to eliminate its Moscow-Genesee county highway grade crossing at Cuylerville station, N. Y., by carrying the highway under the tracks. The cost is estimated at $119,000, exclusive of land and damages.

The Gulf, Colorado & Santa Fe has let a contract to Robert E. McKee, El Paso, Tex., for the construction of a two-story brick storehouse, two one-story brick and reinforced concrete warehouses and a concrete platform at Cleburne, Tex.

The New York Central, the Erie and the Canadian National have been notified by the Public Service Commission of New York that it does not consider as excessive the low bid submitted by the Hecker-Moon Company, Cleveland, Ohio, for the construction, relocation and track elevation required in connection with the elimination of the Austin, Amherst, Tonawanda and other street grade crossings in Buffalo, N. Y. The figure for the entire contract is $510,925, divided as follows: New York Central, $310,949; Erie, $76,405, and Canadian National, $123,571. The railroads have also been directed to award the necessary contracts and to proceed with the work. The New York Central has awarded the contract for its share of the elimination work to the Hecker-Moon Company.

The Norfolk & Western has been authorized by the Interstate Commerce Commission to extend its Jacob's Fork branch and its Dry Fork branch from a point near Newhall, W. Va., northeasterly 8 miles, at an estimated cost of $1,180,000.

The Northern Pacific and the Union Pacific will undertake the construction of a joint line from Moclips, Wash., to the Hoh river, 60 miles, in the Olympic peninsula, about April 1.

The Pennsylvania, in connection with its port and terminal development program at Jersey City, N. J., has awarded to the Terminal Development Company of New York a contract for the construction of a new pier on the location of old pier D, at a probable cost of $1,199,226. The contract for the removal of the old Lehigh Valley-Pennsylvania drawbridge over Newark Bay at Greenville, N. J., has been awarded to J. Rich Steers, Inc., New York City, at an approximate cost of $171,000.

The Pere Marquette has authorized the expenditure of $6,110,000 for new construction as a part of its budget for 1930. Included in the budget, are the construction of grade separation structures at Michigan and Miller avenues, Detroit, Mich., and a new ferry slip in the same city. At Ludington, Mich., it is planned to construct a new ferry slip, a berthing dock and accompanying trackage facilities, with new 80-ft. aprons at the north and south ferry slips, and a new brick passenger station. At Port Huron, Mich., it is planned to construct a new freight station and a new lift bridge over the Black river and to make improvements to the enginehouse, including the extension of several stalls. A new passenger station will be constructed at Bay View, Mich. This road also plans the construction of new water-treating plants at Wyoming, Mich., and New Buffalo and a new water station at Benton Harbor. It is planned to construct new coaling stations at New Buffalo and at St. Thomas, Ont., and Sarnia. The coaling facilities at New Buffalo will be of 300-ton capacity. Passing tracks will be extended at Leamington, Ont., Bridgetown, Rodney, Iona, Dresden and Corunna.

Much Construction in Canada

The two leading Canadian roads, the Canadian Pacific and the Canadian National, are planning unusually extensive construction programs for this year. According to E. W. Beatty, chairman and president of the Canadian Pacific, this road will spend more than $50,000,000 for improvements during the year, including approximately $17,500,000 for terminals and branch lines and $3,500,000 for additions and improvements to hotels. While the Canadian National is devoting much of its attention to the development of its $50,000,000 Montreal terminals, on which $10,000,000 will be spent during the year, work is being continued on the $5,000,000 seven-year program for the improvement of the Point St. Charles shops at Montreal and additional projects are to be undertaken elsewhere on the system.

The Pittsburgh & West Virginia has been authorized by the Interstate Commerce Commission to construct a branch line, extending from a point on the Connellsville extension near Pigeon Creek, Pa., to a connection with the Donora Southern, approximately 6 miles at an estimated cost of $1,397,030.

The Portland Terminal Company, a subsidiary of the Maine Central, has awarded a contract to the Mead-Morrison Manufacturing Company, for the erection of two coal-handling towers at Turners Island, South Portland, Me. A contract has also been let to the Merritt, Chapman & Scott Corp. of New York, for 50 per cent of the work involved in a general program of wharf and warehouse construction at Portland and South Portland. The entire program of port and terminal development, including the contracts mentioned above, involves an expenditure of approximately $2,000,000.

The Sacramento Northern has let a contract to the Utah Construction Company, San Francisco, Cal., for the grading and tracklaying for the construction of a line between Vacaville Jct., Cal., and Creed, 7.5 miles. The total estimated cost of constructing this line is about $400,000.

The St. Louis Southwestern has applied to the Interstate Commerce Commission for authority to build an extension between Van Jct., Tex., and Van, 17 miles, to reach a new oil field.

The Texas Short Line has applied to the Interstate Commerce Commission for authority to construct a line from a connection with the Texas & Pacific at Grand Saline, Tex., to Van, 11 miles, to reach a new oil field.

The Union Pacific has awarded to Peter Kiewit's Sons, Omaha, Neb., the general contract for the construction of the new passenger station at Omaha, comprising its portion of the new union station facilities in that city.

Supply Trade News

General

The Rockbestos Products Corporation, New Haven, Conn., has opened a district sales office in the Railway Exchange Building, St. Louis, Mo.

The Massey Concrete Products Corporation and the **Canadian Concrete Products Company, Ltd.**, have moved their Montreal office to room 310, Dominion Square Building, 1010 St. Catherine street, West.

Personal

Douglas Cameron, at one time district engineer maintenance of way on the Chicago, Burlington & Quincy, has been appointed a representative of the **Electric Tamper & Equipment Company**, Chicago.

Richard B. Carr, manager of Pacific Coast sales of the rail, plate, bar and shape department of the **United States Steel Products Company**, with headquarters at San Francisco, Cal., has retired.

Leonard Perez, assistant tie and timber agent of the Missouri Pacific, has resigned to become district sales manager of the National Lumber & Creosoting Company, in charge of sales in the St. Louis (Mo.) territory and with headquarters in that city.

C. M. Bardwell, assistant water engineer of the Missouri-Kansas-Texas, with headquarters at Waco, Tex., has been appointed southwestern railway representative of the **National Aluminate Corporation**, Chicago, with headquarters at 1313 Santa Fe building, Dallas, Tex.

F. W. Allen, who has been connected with the Chicago sales office of the **Rockbestos Products Corporation**, has been placed in charge of the St. Louis office and **E. H. Clark** has joined the selling organization of the corporation at the Chicago district office.

B. F. Afleck, president of the **Universal Portland Cement Company**, with headquarters at Chicago, has been appointed president of the recently organized **Universal Atlas Cement Company**, at Chicago, which has been organized as a subsidiary of the United States Steel Corporation to take over the business of the **Atlas Portland Cement Company**, New York, and the **Universal Portland Cement Company**, Chicago.

Trade Publications

Trackbarrows.—The American Trackbarrow, Lowell, Mass., has issued a four-page folder describing and illustrating its line of track barrows, carbarrows, pony cars and dolly cars for use in handling maintenance of way materials on the track.

Personal Mention

General

R. S. Kniffen, general roadmaster of the Great Northern, Lines East, with headquarters at Duluth, Minn., has been transferred to the operating department as trainmaster at Fargo, N. D.

John Shea, roadmaster on the Duluth & Iron Range, with headquarters at Two Harbors, Minn., has been appointed assistant superintendent, with the same headquarters, on the Duluth, Missabe & Northern, which now includes the D. & I. R.

Chris McDonough, division superintendent of the Great Northern with headquarters at Seattle, Wash., and formerly assistant roadmaster on that road, has been promoted to general superintendent of the Lake and Eastern districts, with headquarters at St. Paul, Minn.

D. L. Sommerville, superintendent of the Pennsylvania division of the New York Central, with headquarters at Corning, N. Y., and formerly division engineer on that road, has been promoted to assistant to the general superintendent with headquarters at Buffalo, N. Y.

John D. Farrington, formerly connected with the engineering and maintenance of way department of the Chicago, Burlington & Quincy, who has been promoted to general superintendent of the Missouri lines, with headquarters at St. Louis, Mo., has been connected with that company for seven years. He was born at St. Paul, Minn., on January 27, 1891, and after attending high school in that city, entered railway service on June 23, 1909, in the engineering department of the Great Northern. In the summer of the following year he became a timekeeper in the track department of the Burlington, then advancing through the positions of assistant foreman, foreman, roadmaster and assistant trainmaster, and in 1912, he was promoted to trainmaster on the Ottumwa division. During 1917, he served as a lieutenant and a major in the United States Army, then returning to the Burlington as assistant superintendent of the Ottumwa division. Later, during federal control of the railroads, he served on the staff of the federal manager of the Burlington at Chicago, where he remained until March 1, 1920, when he was appointed superintendent of the Quincy, Omaha & Kansas City. On November 1, 1922, Mr. Farrington was appointed superintendent of the St. Joseph division of the Burlington, being transferred to the Aurora division at Aurora, Ill., on August 3, 1923. His promotion to general superintendent of the Missouri lines became effective on January 1.

Engineering

L. P. O. Exley, chief engineer of the Gulf, Mobile and Northern, with headquarters at Mobile, Ala., has been appointed also to a similar position on the New Orleans Great Northern.

George C. Hughel, assistant engineer in the construction department of the Chicago & Western Indiana, has been promoted to office engineer in the chief engineer's office, with headquarters at Chicago.

P. D. Fitzpatrick, chief engineer of the Central Vermont, with headquarters at St. Albans, Vt., has been appointed assistant chief engineer of the Canadian National, in charge of the construction of the Montreal terminal.

R. A. Handley has been appointed assistant engineer on the Louisville & Nashville with headquarters at Paris, Ky., to succeed **A. A. Pogue**, whose appointment as track supervisor is noted elsewhere in these columns.

John G. Sheldrick, resident engineer on the Minneapolis, St. Paul & Sault Ste. Marie, has been promoted to engineer of maintenance of way with headquarters as before at Minneapolis, Minn.

W. H. Woltemate, supervisor on the Reading, with headquarters at Wayne Jct., Philadelphia, Pa., has been appointed division engineer with headquarters at Lamaqua, Pa., succeeding **W. R. Dunn**, who has been transferred to Reading, Pa., to succeed **John S. Goodman**, who has been promoted to superintendent of the Atlantic City Railroad.

Radford Dove, instrumentman in the engineering department of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Kansas City, Mo., has been promoted to assistant engineer in the office of the district engineer with headquarters at Chicago.

W. D. Williams, engineer maintenance of way of the Cincinnati Northern, with headquarters at Van Wert, Ohio, has been appointed division engineer of the Northern divison of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at the same point.

W. H. Miesse, whose appointment as engineer maintenance of way of the Evansville, Indianapolis & Terre Haute, with headquarters at Cincinnati, Ohio, was noted in the February issue, has been appointed division engineer of the Terre Haute division of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at the same point.

R. P. Long, division engineer of the Chicago Terminal division of the Wabash, with headquarters at Chicago, has

been transferred to the Moberly division, with headquarters at Moberly, Mo., succeeding **V. R. Hayes,** who has been transferred to the Decatur division, with headquarters at Decatur, Ill. Mr. Hayes replaces **J. E. Danes,** who retired from active service on February 1. **N. E. Potter,** assistant engineer with headquarters at Decatur, Ill., has been promoted to division engineer with headquarters at Chicago, to succeed Mr. Long.

David Davis, Jr., supervisor of track on the Pennsylvania, with headquarters at Philadelphia, Pa., has been promoted to division engineer of the Elmira division with headquarters at Elmira, N. Y., to succeed **N. M. Lawrence,** who has been transferred to the Buffalo division with headquarters at Buffalo, N. Y., where he succeeds **J. M. Fair,** who has been transferred to Jamaica, Long Island, to replace **J. G. Hartley,** who has been appointed assistant engineer in the chief engineer's office with headquarters at Philadelphia, Pa.

Spencer Danby, whose promotion to division engineer on the Pennsylvania, with headquarters at Chambersburg, Pa., was noted in the February issue, was born on December 12, 1893, at Easton, Pa. He was graduated from Lafayette College with a degree of C. E. in 1914, and entered railway service in December of the following year as a draftsman on the Pennsylvania, with headquarters at Sunbury, Pa. From August, 1916, until March, 1918, he was employed in various ca-

Spencer Danby

pacities in the engineering departments of the Pennsylvania division and the Philadelphia Terminal division at Philadelphia, and he then became an assistant supervisor on the Philadelphia division, with headquarters at Lemoyne, Pa. In February, 1921, he went back to the division engineer's office at Philadelphia, and in March, 1922, he was appointed assistant supervisor at Enola, Pa. In September, 1926, he was promoted to supervisor at Columbus, Pa., and on January 1, 1927, he was transferred to the Atlantic division, with headquarters at the Camden terminal. In July, 1928, he was transferred to the Eastern division, and in August, 1929, he was promoted to assistant division engineer of the Maryland division, with headquarters at Wilmington, Del. He was holding this position at the time of his recent promotion to division engineer.

J. G. Wishart, whose promotion to principal assistant engineer of the Chicago, Rock Island & Pacific was noted in the February issue, has been connected with the engineering department of that road for nearly 26 years. He was born at Niagara Falls, N. Y., in 1879, and after graduating from Englewood High School, Chicago, entered

J. G. Wishart

railway service with the Rock Island at Chicago in 1901. In the following year he became a draftsman on the Chicago & Western Indiana, but returned to the Rock Island as a draftsman at Chicago in 1905. He was advanced to chief draftsman in the engineering department in 1912, and was promoted to office engineer in 1914, with headquarters still at Chicago. His promotion to principal assistant engineer became effective on January 16.

C. B. Brown, chief engineer of the operating department of the Canadian National, with headquarters at Montreal, Que., is now devoting all his time to the development of the new terminal facilities of this road at Montreal. **H. T. Hazen,** assistant chief engineer with the same headquarters, is acting as chief engineer in place of Mr. Brown, with respect to all other matters.

In a reorganization of the engineering department of the Central Railroad of New Jersey, **S. L. Mapes,** engineer maintenance of way with headquarters at Jersey City, N. J., has been made division engineer of the Central division with headquarters at Jersey City. **W. Twining,** engineer maintenance of way of the Lehigh and Susquehanna division, at Mauch Chunk, Pa., has been made division engineer of the same division with the same headquarters. **J. R. Prizer,** who was assistant engineer maintenance of way at Mauch Chunk, has been made division engineer of the Southern division, at Long Branch, N. J. **M. A. H. Scull,** assistant engineer maintenance of way on the Central division, at Jersey City, has resigned.

Track

Curtis B. Brown has been appointed assistant supervisor of track on the Ft. Wayne division of the Pennsylvania, with headquarters at Warsaw, Ind.

J. F. Mayne, roadmaster on the Missouri Pacific, with headquarters at Batesville, Ark., has had his territory extended to include the mileage between Pyatt, Ark., and Cotter.

A. A. Pogue, assistant engineer on the Louisville & Nashville, with headquarters at Paris, Ky., has been appointed track supervisor with the same headquarters, to succeed **Thomas Keller,** retired.

W. Marsh, division roadmaster on the St. Louis-San Francisco, with headquarters at Pittsburg, Kan., has had his territory extended to include the mileage between Pittsburg and Girard, Kan.

Tom Stanfield has been appointed roadmaster on the Chicago, Rock Isalnd & Pacific, with headquarters at Ft. Worth, Tex., to succeed **C. M. Webb,** who has been appointed resident engineer in charge of track relocation.

H. T. Huff, roadmaster on the Norfolk & Western, with headquarters at Roanoke, Va., has been transferred to Pulaski, Va., to succeed **F. L. Burton** who has, in turn, been transferred to Roanoke.

Morris Donahoe, general supervisor of maintenance of the Chicago & Alton, with headquarters at Chicago, has been appointed general roadmaster with the same headquarters.

H. W. Cooper, division roadmaster on the St. Louis-San Francisco, with headquarters at Pittsburg, Kan., has had his territory extended to include the Miami & Mineral Belt, which has recently been acquired by the Frisco.

G. Honey has been appointed acting division roadmaster on the St. Louis-San Francisco, with headquarters at Memphis, Tenn., to replace **J. L. Simpson,** who is on leave of absence.

Thomas Deighton, division roadmaster on the Great Northern, with headquarters at Whitefish, Mont., has been promoted to general roadmaster of Lines East, with headquarters at Duluth, Minn., to succeed **R. S. Kniffen,** whose promotion to trainmaster is noted elsewhere in these columns.

J. M. Rourke, track supervisor on the Baltimore & Ohio, with headquarters at Connersville, Ind., has retired from active service after 46 years of service with that road. **O. Lemmer,** general foreman with headquarters at Cincinnati, Ohio, has been promoted to

track supervisor with headquarters at Indianapolis, Ind., to replace **W. M. Wells,** who has been transferred to Connersville, to succeed **Mr. Rourke.**

D. A. McNeill, section foreman on the Canadian National, with headquarters at Palmerston, Ont., has been promoted to roadmaster on the Stratford division of the Southern Ontario district, with the same headquarters, to succeed **T. Sampson,** retired, whose death is noted elsewhere in these columns.

W. E. Trites, who has been acting division engineer of the Capreol division of the Canadian National, with headquarters at Capreol, Ont., has returned to his position as roadmaster of the Sudbury subdivision of the same division with the same headquarters, following the return of **A. H. Willet,** who has been on leave of absence.

C. E. Butcher, track supervisor on the Chesapeake & Ohio, with headquarters at Raleigh, W. Va., has been transferred to Sciotoville, Ohio, to succeed **Louis Rosemire,** whose death is noted elsewhere in these columns. **W. J. Hedrick,** extra gang foreman on the Hinton division, has been promoted to track supervisor with headquarters at Raleigh, to succeed Mr. Butcher.

R. B. Melton, assistant engineer in the division engineer's office of the El Paso division of the Southern Pacific, with headquarters at El Paso, Tex., has been appointed acting roadmaster on the same division, with headquarters at Spofford, Tex., to succeed **H. I. Barnett,** whose death is noted elsewhere in these columns.

P. Shaw, track foreman on the Minneapolis & St. Louis, with headquarters at Grand Junction, Iowa, has been appointed assistant supervisor of track with headquarters at Hopkins, Minn., to succeed **F. B. Clark,** who has been promoted to supervisor of track with heaquarters at Estherville, Iowa, to succeed **C. S. Weatherill,** whose appointment as supervisor of bridges and buildings is noted elsewhere in these columns.

C. H. Vogt, supervisor on Subdivision 14 of the Rochester division of the New York Central, with headquarters at Rochester, N. Y., has been made supervisor on the Terminal district of the Central Railroad of New Jersey, with headquarters at Jersey City, succeeding **S. G. Phillips,** who has become a supervisor on the Boston & Maine, with headquarters at Boston, Mass. **J. I. Thompson,** on special duty in the president's office, has been appointed assistant supervisor on the Terminal district, with headquarters at Jersey City, succeeding **H. J. Phillips,** resigned.

J. A. Heeks, transitman on the engineering corps of the Syracuse division of the New York Central, with headquarters at Syracuse, N. Y., has been promoted to assistant supervisor of Subdivision 14 of the Rochester division, with headquarters at Rochester, succeeding **M. Brophy,** who has been transferred to Subdivision 11, Syracuse division, with headquarters at Rochester. Mr. Brophy succeeds **M. W. Feeney,** who has been promoted to supervisor of Subdivision 14, of the Rochester division, with headquarters at Rochester, relieving **C. H. Vogt,** who has resigned to become a supervisor on the Central Railroad of New Jersey, as noted elsewhere in these columns.

R. W. Morrison, whose promotion to supervisor of track on the Reading, with headquarters at Shamokin, Pa., was noted in the February issue, was born on July 30, 1903, at Bangor, Me. He received his higher education at the University of Maine, from which he was graduated in 1925, and entered railway service on September 16, 1925, with the Reading, as a levelman in the office of the chief engineer at Philadelphia. On March 8, 1926, he was promoted to assistant supervisor on the Harrisburg division, with headquarters at Harrisburg, Pa., and later served in this capacity on several divisions until January 6, 1930, when he was made acting supervisor on the New York division, with headquarters at Manayunk, Pa., the position he was holding at the time of his recent promotion to supervisor.

E. R. Shultz, whose promotion to supervisor on the Cleveland division of the Pennsylvania, with headquarters at Ravenna, Ohio, was noted in the February issue, was born on October 25, 1903, at Kimmell, Pa., and graduated from Pennsylvania State College in 1924. He immediately entered railway service with the Pennsylvania as an assistant on the engineers corps at New Castle, Pa., where he remained until July 16, 1929, when he was promoted to assistant supervisor on the Pittsburgh division at Pittsburgh, Pa. On November 16, he was transferred to the Eastern division, with headquarters at Alliance, Ohio, where he remained until his promotion to supervisor, effective December 1.

M. W. Parse, whose promotion to roadmaster on the Missouri Pacific, with headquarters at Kansas City, Mo., was noted in the February issue, has been with that road since 1922, with the exception of three years spent in state highway work. He was born at Batesville, Ark., on September 26, 1899, and graduated with a degree in civil engineering from Washington and Lee University in 1921. A year later he entered the service of the Missouri Pacific as a rodman on the Central divison and on February 9, 1923, he was transferred to the Memphis division, where he was located until January 25, 1924, when he was promoted to instrumentman on the same division. On March 31, 1924, Mr. Parse left the M. P. to become assistant division engineer with the Arkansas State Highway department, where he was subsequently promoted to assistant district engineer. He returned to the M. P. as a rodman on the Arkansas division on January 5, 1927. On April 6, 1927, he was promoted to instrumentman on the Kansas City Terminal division where he remained for four months, then being transferred to the Louisiana division. On September 1, 1928, he was sent to St. Louis, Mo., where he was connected with construction work and track changes in connection with the south approach to the municipal bridge. On June 16, 1929, Mr. Parse returned to the Arkansas division, where he was in charge of relaying rail. He received his promotion to roadmaster on December 16, 1929.

Vernon W. Gray, assistant on the engineer corps of the Pennsylvania, with headquarters at Ft. Wayne, Ind., has been promoted to assistant supervisor with headquarters at Harrington, Del., to succeed **D. E. Smucker,** who has been transferred to Lemoyne, Pa., where he replaces **R. P. Hebard,** who has been transferred to the Maryland division, with headquarters at Perryville, Md. Mr. Hebard replaces **J. A. Schwab,** who has been promoted to supervisor on the Elmira division, at Elmira, N. Y., where he succeeds **H. O. Gray,** who has been transferred to Atlantic City, N. J., to replace **R. W. Sheffer,** who has been transferred to the Philadelphia Terminal division at Philadelphia, Pa, to succeed **David Davis, Jr.,** whose promotion to division engineer is noted elsewhere in these columns.

A. W. Miller, assistant on the engineering corps of the Pennsylvania, with headquarters at Lemoyne, Pa., has been promoted to assistant supervisor at Millersburg, Pa., succeeding **O. N. Essex,** who has been transferred to Huntingdon, Pa., where he succeeds **J. T. Honker,** who has been transferred to Harrisburg, Pa. **R. P. Bill,** assistant on the engineering corps, with headquarters at Wilmington, Del., has been transferred to Harrisburg, Pa., where he succeeds **C. L. Snarely,** who has been promoted to assistant supervisor at Osceola, Pa. **W. T. Miller,** maintenance of way general foreman with headquarters at Osceola, has been promoted to assistant supervisor on the Columbia and Port Deposit line of the Maryland division. **C. D. Merrill,** assistant supervisor on the Ft. Wayne division has been transferred to the Philadelphia Terminal division, at North Philadelphia, Pa.

E. A. Edson has been appointed assistant supervisor in the division engineer's office of the Harrisburg division of the Reading, succeeding **J. G. Smith, Jr.,** who has been transferred to the New York division, with headquarters at Trenton Junction, N. J., to replace **B. K. Wingate,** who has been promoted to supervisor on the Harrisburg division, with headquarters at Boiling Springs, Pa. Mr. Wingate succeeds

S. V. Keeler, who was transferred to the Atlantic City Railroad, with headquarters at Camden, N. J., succeeding **J. T. Sturman,** who has been transferred to the Philadelphia division, with headquarters at Wayne Junction, Pa., to relieve **W. H. Woltemate,** whose promotion to division engineer is noted elsewhere in these columns. **J. H. DeFrees** has been appointed assistant supervisor on the New York division, with headquarters at Philadelphia, Pa., succeeding **C. A. Tracy,** who has been transferred to the New York division, with headquarters at Philadelphia, to replace **L. B. Lewis,** who has been appointed acting supervisor on the Manayunk elevation work at Manayunk, Pa. **J. W. Gohl,** has been appointed supervisor on the Shamokin division, with headquarters at West Milton, Pa., succeeding **L. A. Lewis,** retired.

Bridge and Building

A. H. Bandy, bridge and building supervisor on the Missouri Pacific, with headquarters at Wichita, Kan., has retired from active service.

W. J. Phillips Foi, has been appointed assistant general bridge and building inspector of the Southern Pacific, with headquarters at San Francisco, Cal.

J. F. Drake, supervisor of bridges and buildings on the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Arcanum, Ohio, has retired from active service.

D. T. Rintoul, general bridge inspector of the Southern Pacific, with headquarters at San Francisco, Cal., has been promoted to assistant engineer of bridges with the same headquarters.

W. J. Coughlin, assistant bridge and building master on the Canadian National, with headquarters at Capreol, Ont., has been promoted to bridge and building master with headquarters at Hornepayne, Ont.

J. A. Youngblood has been appointed supervisor of bridges and buildings of the Mobile and Meridian districts of the Mobile & Ohio, with headquarters at Meridian, Miss., to succeed **W. L. Bennett,** deceased.

H. M. Smith has been appointed supervisor of bridges and buildings on the Montgomery district of the Mobile & Ohio, with headquarters at Tuscaloosa, Ala., to succeed **S. W. Cheatham,** deceased.

H. C. Jones, bridge and building inspector on the Southern district of the Portland division of the Southern Pacific, has been transferred to the Northern district of the same division, with headquarters at Portland, Ore.

C. S. Weatherill, supervisor of track on the Minneapolis & St. Louis, with headquarters at Estherville, Iowa, has been appointed supervisor of bridges and buildings with headquarters at Ft. Dodge, Iowa, to succeed **E. R. Reed,** who has been transferred to Minneapolis, Minn., to succeed **J. G. Kane,** who is acting as special inspector.

L. B. Larson, has been appointed chief carpenter of the Des Moines division and part of the Iowa division of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Perry, Iowa, to succeed **E. A. Evans,** who has been assigned to other duties.

W. C. Webster, bridge and building foreman on the Southern Kansas division of the Missouri Pacific, has been promoted to bridge and building supervisor with headquarters at Coffeyville, Kan., to succeed **P. F. Gentine,** whose death is noted elsewhere in these columns.

F. C. Brackett, assistant supervisor of bridges and buildings on the Boston & Maine, with headquarters at Dover, N. H., has been promoted to supervisor of bridges and buildings on the Terminal division, with headquarters at Boston, Mass., succeeding **S. E. Dufort,** assigned to other duties.

Obituary

T. Sampson, retired roadmaster on the Canadian National, died at his home at Palmerston, Ont., on January 15.

E. L. McNeil, supervisor on the Maryland division of the Pennsylvania, with headquarters at Chester, Pa., died at his home in Chester on February 13.

F. T. Folsom, roadmaster on the Joplin division of the Missouri-Kansas-Texas, with headquarters at Parsons, Kan., died on February 6 at Columbia, Kan.

T. B. Metcalf, supervisor of track on the Pennsylvania, with headquarters at Ft. Wayne, Ind., who has been on leave of absence, died at Shreve, Ohio, on January 27.

Charles Bach, retired supervisor of bridges and buildings on the Chicago & North Western, died at his home at Belle Plaine, Iowa, on December 2, 1929, after a long illness.

S. W. Cheatham, supervisor of bridges and buildings on the Montgomery district of the Mobile & Ohio, with headquarters at Tuscaloosa, Ala., died on December 17, 1929.

P. F. Gentine, bridge and building supervisor on the Southern Kansas division of the Missouri Pacific, with headquarters at Coffeyville, Kan., died at his home in that city on December 31.

George E. Hanks, retired supervisor of bridges and buildings on the Pere Marquette, died on February 1, at Saginaw, Mich. Mr. Hanks was born on August 29, 1847, at Buffalo, N. Y., and entered railway service with the Grand Rapids & Indiana (now part of the Pennsylvania) about 1870, in the bridge and building department. On September 2, 1872, he entered the service of the Flint & Pere Marquette (now part of the Pere Marquette) and was appointed master carpenter in 1904, at Saginaw, Mich. In 1906, he was appointed supervisor of bridges and buildings with the same headquarters, which position he was holding at the time of his retirement in 1912.

F. J. Leavitt, who retired as supervisor of bridges and buildings on the Boston & Maine, with headquarters at Sanbornville, N. H., on August 7, 1929, died at his home in that city on January 9.

Louis Rosemire, supervisor of track on the Chesapeake & Ohio, with headquarters at Sciotoville, Ohio, died in December as a result of burns which he suffered while rescuing his family from their burning home on the night of December 21.

Daniel Wingerd Gross, assistant to the president of the Atlantic Coast Line and formerly connected with the engineering department of that road, died on January 23. He was born on September 25, 1871, at Harrisburg, Pa., and was educated in civil engineering at Pennsylvania State College. He entered railway service with the Beech Creek (now part of the New York Central) in 1893, as a rodman and served with various roads until 1906, when he became connected with the A. C. L. From 1906 to 1913, he was engineer of construction, being in the latter year promoted to valuation engineer, which position he held until 1918, when he was appointed corporation engineer. He was promoted to assistant to the president in 1920.

H. I. Barnett, roadmaster on the El Paso division of the Southern Pacific, with headquarters at Spofford, Tex., whose death occurred in the Santa Rosa hospital at San Antonio, Tex., on January 18, was born on March 10, 1861. After completing his public school education, he served as a track laborer for various roads in the south and southwest. On July 14, 1900, he entered the service of the International-Great Northern as a section foreman, but resigned on September 28, 1903, to become a car carpenter on the St. Louis Southwestern, where he remained until October 17, 1905, when he resigned to engage in the grocery business at Tyler, Tex. He returned to the I. G. N. as section foreman on January 10, 1906, but again resigned a year later to re-enter the grocery business at Tyler. On June 20, 1907, Mr. Barnett returned to the I. G. N. as a section foreman, but four months later he left this company to become a section foreman on the Southern Pacific, with which company he served continuously until his death. He was promoted to roadmaster at Del Rio, Tex., on October 4, 1920, being transferred to Hondo, Tex., in 1925, and to Spofford in 1926, where he remained until his death.

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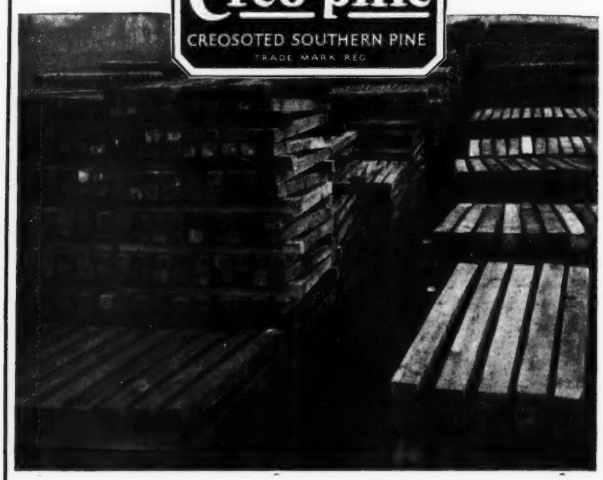

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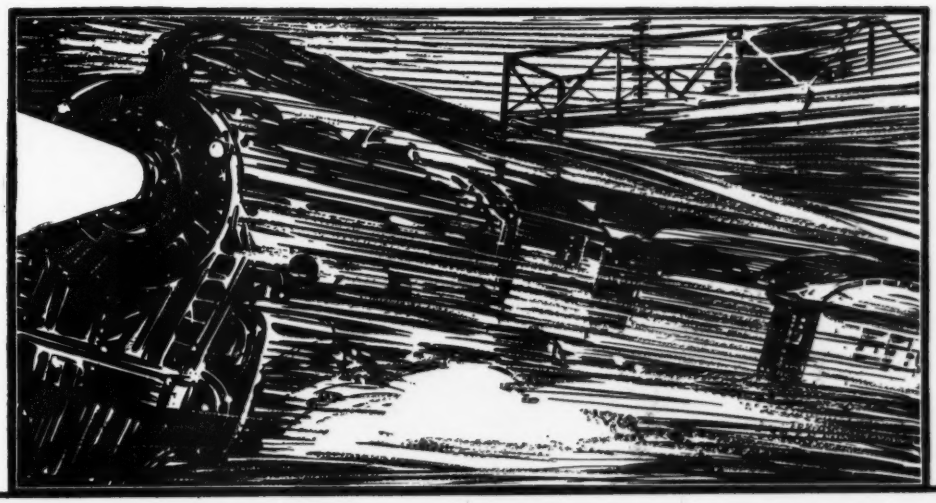

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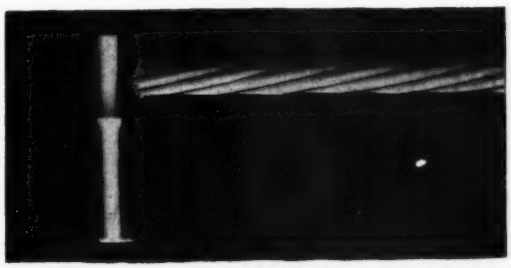

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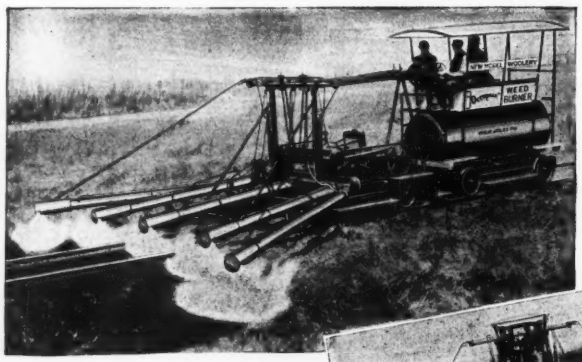

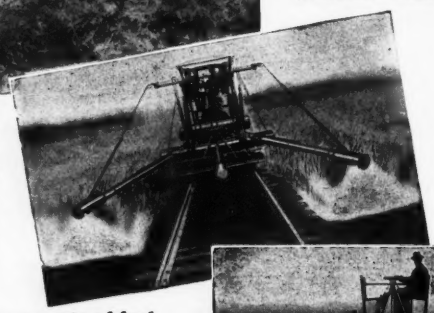

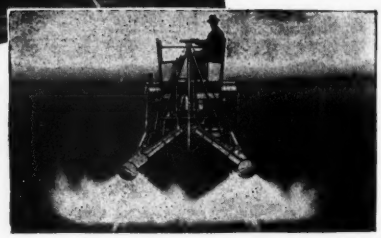

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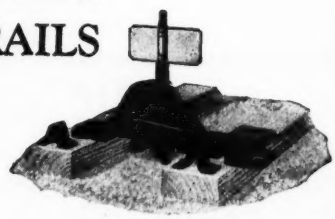

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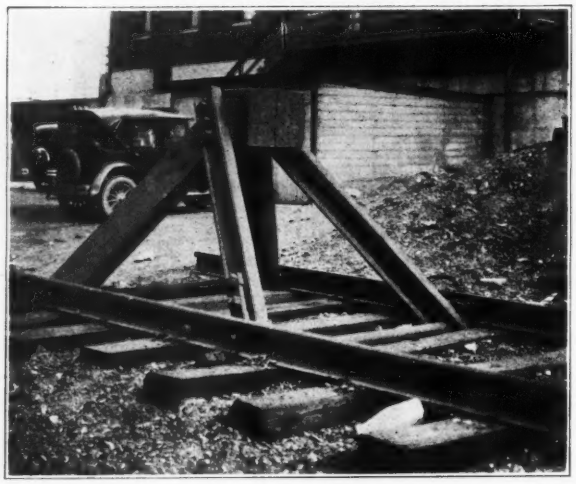

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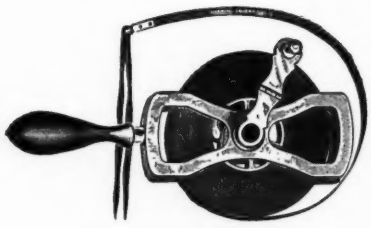

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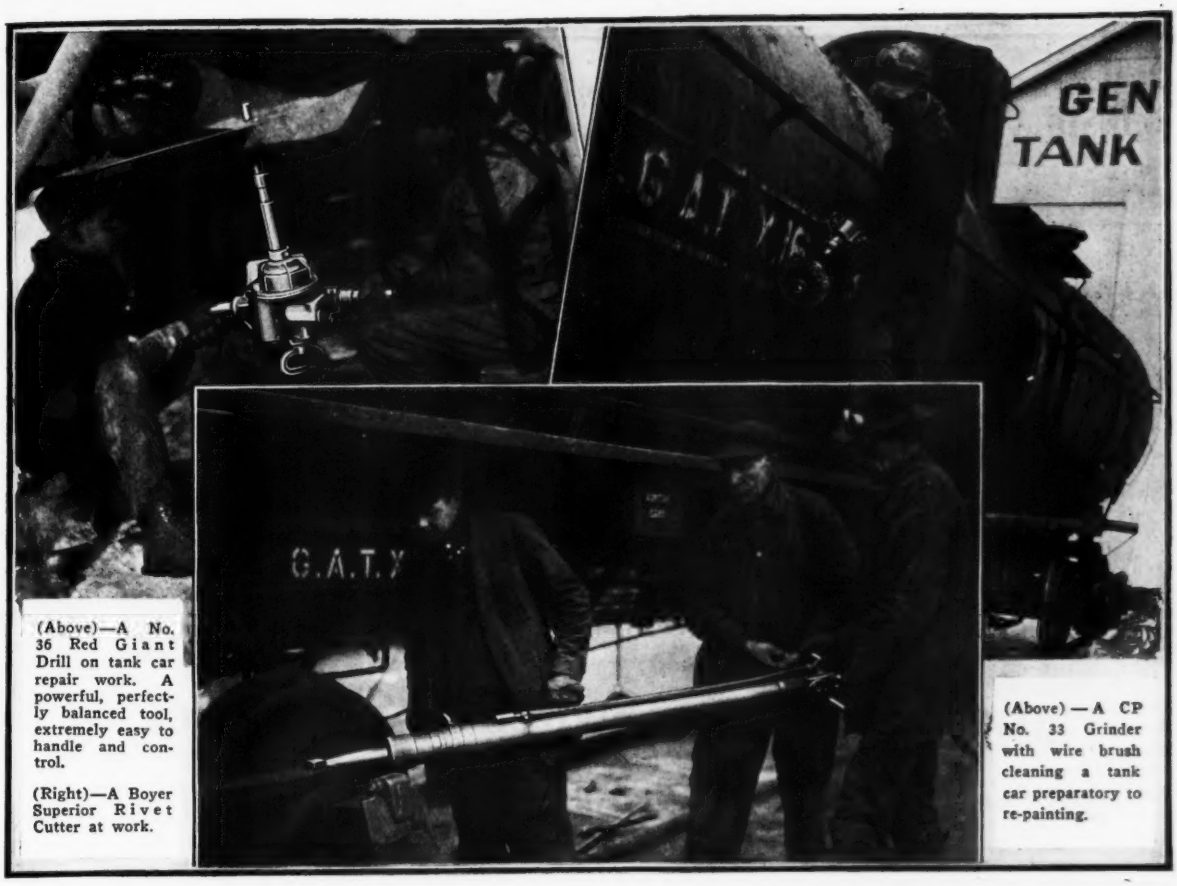

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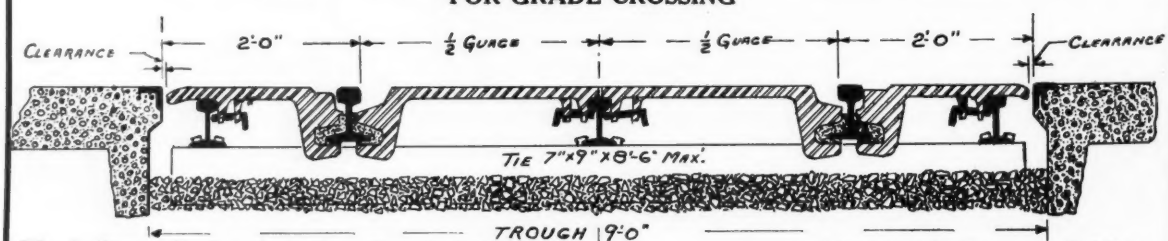

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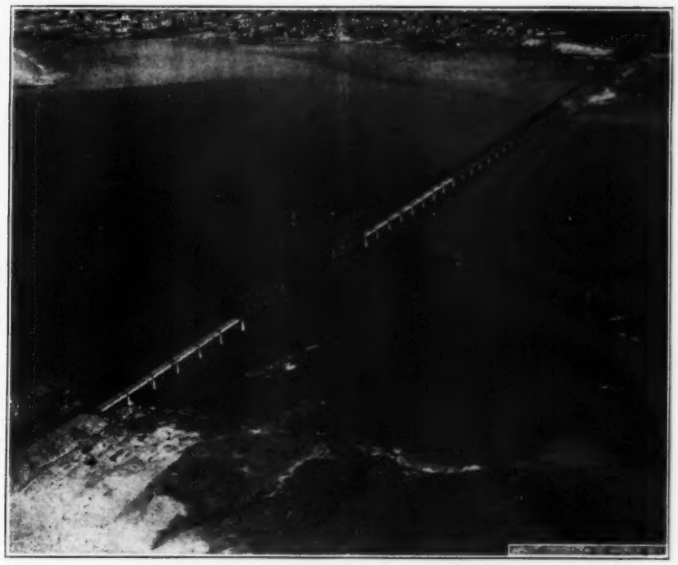

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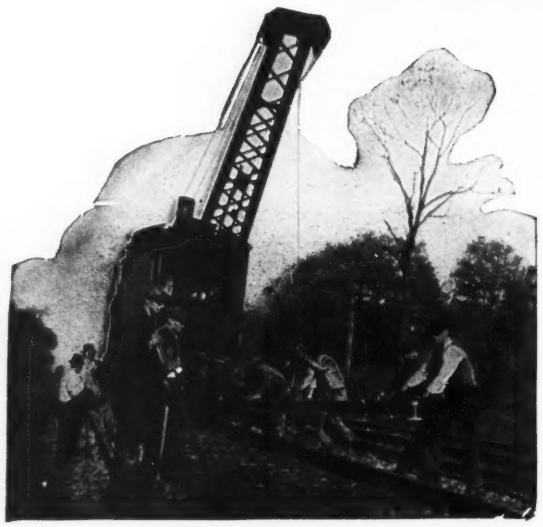

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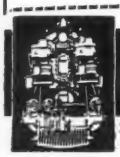

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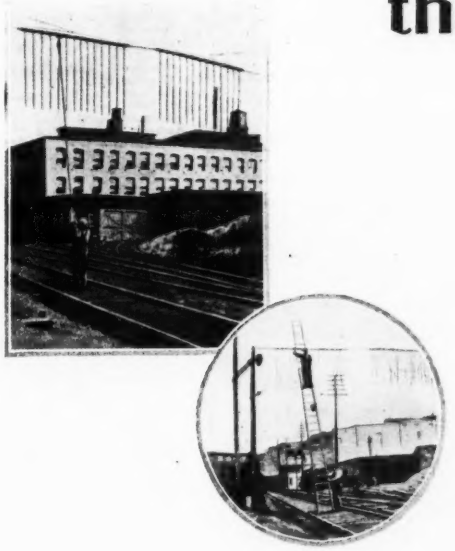

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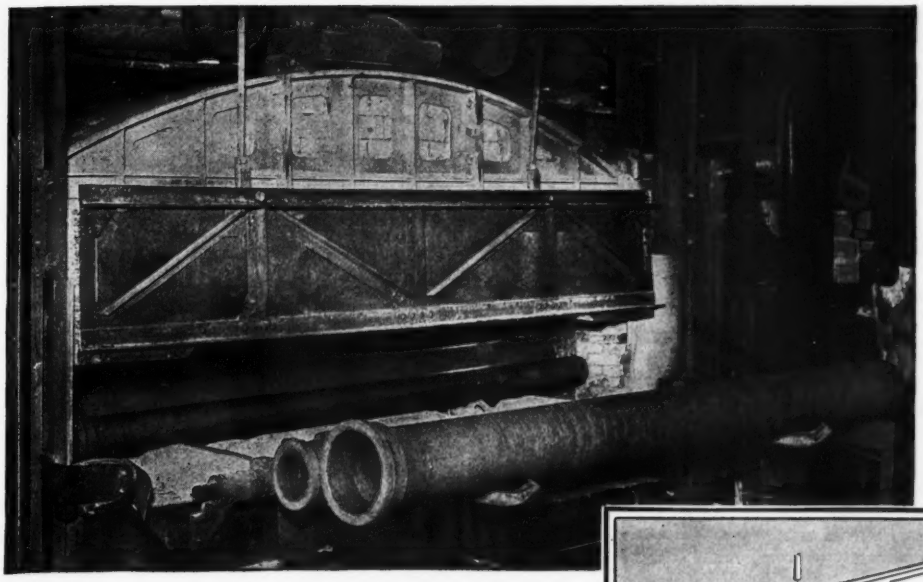
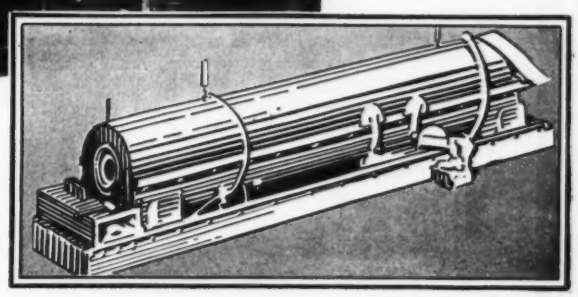


The large photograph shows the deLavaud annealing furnace where controlled temperatures uniformly anneal every length of deLavaud pipe.

Below is the famous deLavaud machine which produces the strongest cast iron pipe known.



Controlled annealing gives deLavaud pipe uniform strength and flexibility

THE controlled annealing in the manufacture of deLavaud pipe may be regarded as one of the greatest advances in the cast iron pipe industry. All cast iron pipe must be annealed at some stage of its manufacture. For annealing, as every engineer knows, reduces brittleness and tends to eliminate casting strains.

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